ARCHIVES of OPHTHALMOLOGY

VOLUME 10 (old series Volume 67) NOVEMBER, 1933 NUMBER 5

INDICATIONS FOR TREATMENT FOR COMBINED LATERAL AND VERTICAL STRABISMUS

JAMES W. WHITE, M.D.

NEW YORK

Statements are often made that in combined lateral and vertical strabismus operation for the lateral should always be done first. A counterstatement is frequently made, that the vertical squint should be corrected first. Neither statement is correct, and the decision as to which deviation to correct first rests on fairly definitely determined principles.

These principles include the type of the lateral strabismus, whether a convergent strabismus is simply of the convergence excess type or whether a divergence insufficiency has been added; or whether a divergent strabismus is a primary convergence insufficiency with a secondary divergence excess or whether, as is frequently seen, there is a definite primary divergence excess with or without a secondary convergence insufficiency. It must also be determined whether the lateral muscles are inherently too strong or too weak. Then it must be determined which vertical muscle or muscles are paretic and whether there are secondary deviations of the associate antagonists or secondary contractures of the direct antagonists. A deciding factor is often whether the paralysis of the vertical muscle is unilateral or bilateral. If bilateral, one must determine whether there is a double hyperphoria or hypertropia in the primary position and, if so, whether the two are equal or unequal in amount and what pair of muscles produces the condition.

To summarize the requisite steps in determining the nature of a case in hand:

1. Determine the amount of the combined lateral and vertical deviation for distant and near vision and note whether the prism which corrects the vertical deviation lessens to any appreciable extent the lateral deviation and, if so, how much.

2. Note the character and measure the absolute or relative convergence near point.

3. At about 33 cm. measure the lateral and vertical deviation combined in the six cardinal fields, noting again the effect produced on the lateral deviation by the correction of the vertical deviation.

4. Make excursion tests in the six cardinal positions with first one eye fixing, then the other. This test best shows the amount of paralysis

Read in part before the Section of Ophthalmology, New York Academy of Medicine, May 15, 1933.

of a muscle, but is especially valuable in determining the character of the secondary deviations and secondary contractures. This test is often the pivotal point on which the choice of operation depends.

5. Know the effect of an ametropic correction. Minus lenses will not infrequently change a divergent strabismus to an exophoria, or, less frequently, an approximate orthophoria to an esophoria or esotropia. A plus lens frequently changes an esotropia to an esophoria, or even to an exophoria, and not infrequently produces a definite exotropia. Consequently the amount of deviation should be measured for distant and near vision both with and without the ametropic correction.

Many patients with combined squints have a small amount of hypermetropia or myopia, which has no effect in producing the deviation; nor will the wearing of glasses have any effect in relieving the deviations.

The vertical muscle most commonly complicating a lateral strabismus is the superior rectus. The involvement may be unilateral or bilateral. Next in frequency is the inferior rectus, which also may cause unilateral or bilateral involvement. The inferior oblique is less frequently paretic, but is affected more frequently than the literature would lead one to believe. The superior obliques are rarely found affected. Bielschowsky believes that the superior obliques are quite commonly involved, but in many cases observed by me, in which this opinion may have been held and in some cases was held, I have been able by postoperative findings to prove the contrary. In a few cases the superior oblique has appeared to be definitely paretic, but by tenotomy of a powerful inferior oblique the superior oblique has functioned normally and was believed to be only mechanically limited. If these cases were cases of primary paralysis of the superior oblique, tenotomy of the inferior oblique would result in an underaction of this muscle in its field of elevation, while the superior oblique would still show a limitation in its field of action. For example, if the left inferior oblique was operated on for paralysis of the left superior oblique, the result would be right hyperphoria on looking up and right, and left hyperphoria on looking down and right. This has not been observed after tenotomy of the inferior oblique in my experience.

The importance of combined squints was impressed on me in 1914 during my first year with Duane. A child who had been operated on by a capable surgeon was referred to him. Some time after the operation, the eyes again crossed and the patient was reoperated on; later the eyes again crossed. It was at this point that the patient was referred to Dr. Duane. A vertical deviation of 15 Δ was found; it was caused by paresis of the superior rectus. Tenotomy of the inferior oblique corrected the deviation completely in the ordinary positions of gaze, and the convergence was corrected by the hyperopic correction of 4.50

diopters. Had the vertical deviation been corrected primarily, the first operation on the lateral deviation would probably have sufficed.

A second example was the case of a man, aged 30, with a marked divergent strabismus who was seen during the past year. The history given was that some time before he had a recession of the externi. After this his eyes crossed, and one externus was advanced when the eye diverged again. On examination there was found to be a left hypertropia of 20 Δ, which increased with the eyes turned up and to the right, or paralysis of the right superior rectus.

A third case was one of my own; a boy, aged 2½ years, had a divergent strabismus of 35 Δ for distant vision and an exophoria of 35 Δ for near vision. The convergence near point was normal. Orthoptic and converging exercises were used for one year, and when measured at the end of this time, the exotropia for distant vision had not changed, but the exophoria for near vision had been reduced to 15 Δ, with a PcB [1] of 60 mm. A recession of both externi was done at this time, and at the end of three months there was a trace of esophoria for distant vision and 7 Δ for near vision. Six months later the esophoria was 5 Δ for distant vision and 20 Δ for near vision, which was at times an esotropia. The esophoria increased in one year to 30 Δ for distant and near vision, thus changing a divergent strabismus of 35 Δ to a convergent strabismus of 30 Δ, or a swing of 65 Δ or 65 actual degrees by a moderate double recession of the externi. The externus of the squinting eye was resected. After this the patient had an esophoria of 5 Δ for distant and near vision with his correction, which was +2.00 +1.25 cyl. 105° for the right eye and +2.00 +1.25 cyl. 75° for the left eye. Vision was 20/20 in each eye. A left hyperphoria of 4 Δ was then determined, which increased to 9 Δ on looking up and right. It is quite probable that the divergent strabismus and later the convergent strabismus were caused by the vertical deviation. At the present time, the patient fuses with the amblyoscope and stereoscope with depth perception and has only a trace of esophoria with his correction. If the vertical deviation requires operation later, a resection of the right superior rectus will be indicated. In similar cases the effect on the divergence strabismus produced by first correcting the vertical deviation has been so satisfactory that the vertical deviation is corrected first almost as a routine procedure.

In these cases definite rules are made only to be broken. Generally speaking, in cases of paralysis of the superior rectus they are as follows:

1. When the vertical deviation is unilateral and less than 5 Δ with a convergence strabismus, a recession of the internus of one or both

1. PcB means the convergence near point measured from the intracentral base line.

eyes may be sufficient, but a resection of the externus of the squinting eye may have to be performed as well.

2. When the vertical deviation is bilateral, producing a double hyperphoria or hypertropia, if the double hyperphoria is not over 10 Δ and the right and left hyperphoria are about equal in the primary position, a double recession of the interni, supplemented, when necessary, by a resection of one or both externi, should be performed.

In cases of divergent strabismus with a unilateral paralysis of the superior rectus, even of a small amount, a tenotomy of the inferior oblique is usually indicated. If the divergence is corrected by either a tenotomy of the externus or a resection of the internus, the eye would be more in the field of the inferior oblique as an elevator and so the upshoot would be increased. In bilateral cases of the same type, a double tenotomy of the inferior obliques is usually performed first; if the divergence is alternating and is due to a divergence excess, this is followed by a double recession of the external recti. When a convergence insufficiency is present, a resection of one or both interni is chosen, supplemented, when indicated, by a recession of one or both externi.

3. When a unilateral vertical deviation over 5 Δ is found and is associated with a convergent strabismus, if the patient fixes with the paretic eye and the secondary deviation increases the deviation to 10 Δ or more, the inferior oblique is tenotomized and later a recession of the internus, a resection of the externus or both are performed, as indicated. It is important to wait long enough to determine the effect of the first operation on the lateral strabismus.

If the strabismus is confined to one eye, a tenotomy of the externus and resection of the internus should follow the operation on the inferior oblique.

When the case is complicated by a secondary contracture of the inferior rectus, the procedure is to tenotomize the inferior oblique first. When sufficient time has passed to consider the result as permanent, if the secondary contracture is still present, a recession of the inferior rectus is the next step. After the permanent effect of this operation has been reached, the lateral deviation may be corrected by operating on the lateral muscles according to the usual principles underlying the correction of lateral strabismus.

When this type of deviation is bilateral, a double tenotomy of the inferior obliques is indicated unless the superior recti are quite paretic, when this procedure would leave an insufficient power of elevation. In such a case, a double resection of the superior recti is better. In unilateral cases, when fixation is preferred with the nonparetic eye, a resection of the paretic superior rectus is likewise the better procedure.

When the vertical deviation is due to a paralysis of one or both inferior recti, these muscles should be resected first, supplemented by

a recession of the superior recti. The lateral deviation is then corrected on the principles governing the correction of lateral strabismus. These cases are frequently seen after suppression has been established and the muscular imbalance is causing no particular symptoms. In these cases no surgical procedure is indicated unless, on testing, the faculty of fusion can be readily restored and the desire to fuse is made strong enough to remain permanent.

When the inferior oblique is paretic, a recession of the superior rectus of the other eye is indicated.

In no case of paralysis of the superior oblique has the lateral deviation been enough to have it considered in this paper. A recession of the inferior rectus of the other eye has corrected the vertical deviation in a number of cases and has relieved the diplopia and the tilt of the head; this should be the first procedure if a lateral strabismus complicates the case.

REPORT OF CASES

CASE 1.—J. O., aged 5½, had ametropia in both eyes requiring +0.75 cyl. There was an esotropia of 30 Δ for distant vision and of 40 Δ for near vision, with a right hypertropia of 7 Δ. The right hypertropia increased with the eyes turned up and to the left, but with the eyes turned up and to the right, there was an increasing left hypertropia.

The diagnosis was convergent strabismus with paralysis of both superior recti without much secondary deviation of the inferior obliques. A recession of both interni resulted in an esophoria of 1 Δ for distant and near vision with fusion.

CASE 2.—V. Q., aged 4, had ametropia in both eyes requiring +1.50 sphere. There was an esotropia of 40 Δ for distant vision and of 50 Δ for near vision. Paralysis of both superior recti was present, with a slight secondary deviation of the inferior oblique. A recession of both interni resulted in orthophoria for distant vision. There was esophoria of 2 Δ for near vision with fusion.

CASE 3.—H. M., aged 11, had vision of 20/100 in the right eye with a correction of +2.00 +0.50 cyl. 90° and of 20/20 in the left eye with a correction of +1.50 +0.25 cyl. 90°. There was an esotropia of 28 Δ for distant vision and of 40 Δ for near vision. The patient fixed with the left eye, and the right eye was converged and decidedly higher. There was a right hypertropia with the eyes up and to the left and a left hypertropia with the eyes up and to the right. The convergence near point was good. A recession of both interni and a resection of the right externus were advised on account of the nearly equal double hyperphoria, as it was thought that the lateral correction would limit the upshoot enough for a cosmetic result.

CASE 4.—A. K., aged 8, fixed the right eye for distant vision and the left eye for near vision. The left eye was myopic, 1.5 diopters (fig. 1).

There was an exotropia of 60 Δ for distant and near vision, with a very remote relative PcB. There was a double hypertropia with the eyes in the primary position which varied in the different fields, as shown in figure 1. The right hypertropia increased to 60 Δ with the eyes up and to the left, and the left hypertropia increased to 30 Δ with the eyes up and to the right.

A double tenectomy of the inferior oblique was advised. The operation stopped the upshoot and lessened the amount of double hypertropia. The exotropia was

reduced to 20 Δ. Converging and fusion exercises are being used, and the myopia is being corrected. Further treatment will depend entirely on the response to this postoperative training.

CASE 5.—R. K., aged 5, had a considerable limitation of the superior recti, with a markedly overacting inferior oblique of each eye (fig. 2, *3* and *4*). In figure *2*, *5* and *6* show a markedly overacting inferior rectus in each eye, with an apparent underacting superior oblique in each eye. In three or four of the cases observed the superior oblique was definitely underacting. This underaction may be congenital, but in one case it was definitely caused by a powerful inferior

Fig. 1 (case 4).—In *1* the right eye is fixed for distant vision; in *2* the left eye is fixed for near vision. In *3* the eyes are turned to the right; in *4*, to the left. In *5* the eyes are turned up and to the right; in *6*, up and to the left. In *7* the eyes are turned down and to the right; in *8*, down and to the left.

oblique and after tenotomy of the inferior oblique, the superior oblique gradually regained its function. In figure *2*, *7* shows the appearance after a double tenotomy of the inferior oblique, the two muscles being operated on at the same time. This procedure was justified as both superior recti were equally paretic but had fair function, whereas each inferior oblique had a marked secondary deviation.

When the superior recti are not equally paretic, with the greater secondary deviation in the field of the more paretic superior rectus, it is much safer to tenotomize the more overacting inferior oblique first. Later it may seem wiser

to advance the superior rectus of the same eye, rather than to tenotomize the inferior oblique of the other eye.

The final result after resection of the left external rectus is shown in *8* of figure 2.

There are fusion and orthophoria for distant and near vision. With the eyes turned up and to the right there is a right hyperphoria. When there is as much inequality with the eyes turned up and to the right or the left as there is in this case, a safer procedure would be first to tenotomize the right inferior oblique and later to perform a complete or modified tenotomy on the left inferior oblique, or, at times, a resection of the left superior rectus.

My procedure for a modified tenotomy of the inferior oblique is to engage the muscle as is done in the more radical operation. The sheath of the muscle is then split longitudinal to the muscle. The muscle fibers are then dissected

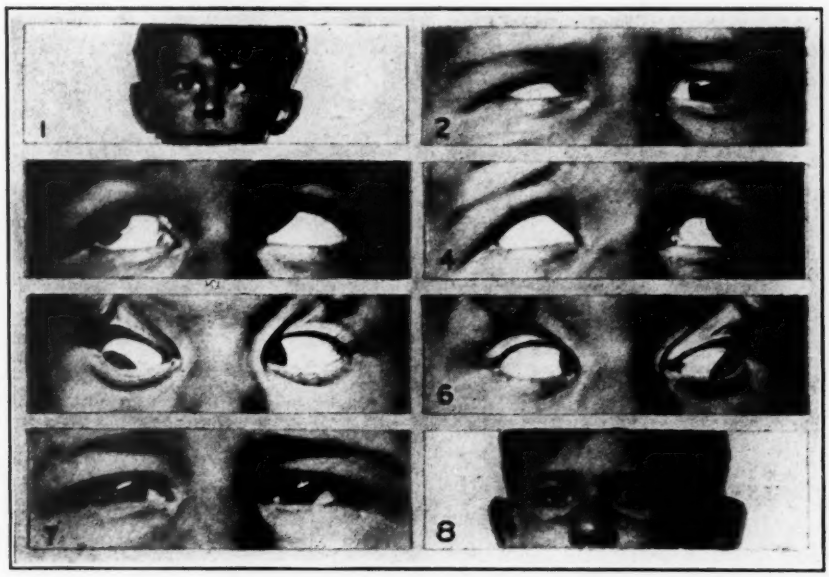


Fig. 2 (case 5).—In *1* the patient is fixing with the right eye; in *2*, with the left eye. In *3* and *4* a considerable limitation of the superior recti is seen, with a markedly overacting inferior oblique in each eye. In *5* and *6*, a markedly overacting inferior rectus in each eye is seen, with an apparent underacting superior oblique. In *7* is shown the appearance after double tenotomy of the inferior obliques. In *8* is seen the final result after resection of the left external rectus.

from the sheath and as much of the muscle fibers resected as is judged sufficient for the result sought.

CASE 6.—L. G., aged 25, gave the history of a divergent strabismus since she was quite young. For some years the head had been tilted back to the left. There was ametropia; with a correction of —3.00 —3.00 cyl. 180°, vision in the right eye was 20/20; with a correction of —1.37 —2.87 cyl. 165°, vision in the left eye was 20/20.

There was an alternating exotropia of 20 Δ for distant vision, with a right hypertropia of 15 Δ. For near vision, there was an exotropia of 35 Δ, with a hypertropia of 20 Δ. The PcB was 70 mm. when the eyes fixed a vertical line

5 cm. in length. When the right hypertropia was corrected by prisms, the exotropia for distant vision was reduced to 15 Δ, and for near vision to 19 Δ. When the hyperexotropia was corrected by prisms, there was binocular single vision. The right inferior oblique was operated on, and both external recti were receded.

The double recession was chosen because of the good PcB.

The final result was an esophoria of 1 Δ for distant vision and an exophoria of 3 Δ for near vision, with no hyperphoria in either position. The PcB was 60 mm. This patient was operated on in 1916; she has resided in California for the past ten years, but when last heard from she had no return of the deviation.

Case 8.—D. X., aged 33, had ametropia, with a correction of +0.25 +0.25 cyl. 75° in the right eye and of +1.00 +1.25 cyl. 135° in the left eye. There was an exotropia of 30 Δ for distant and near vision. The left hypertropia was 7 Δ; it increased with the eyes turned down and to the left.

The diagnosis was paralysis of the left inferior rectus with a divergent strabismus. Treatment should consist in resection of the left inferior rectus, and then, for the divergent strabismus, a resection of the internus, a recession of the externus or both, as indicated, some time after the operation on the inferior rectus.

Case 9.—M. B., aged 12, had convergent strabismus on the right side. Vision was 20/25 in both eyes. There was ametropia requiring a correction of +6.00 +1.50 cyl. 90° in the right eye and of +6.00 +0.75 cyl. 90° in the left eye. Seven years previously double recession of the interni was performed. There was an esophoria of 25 Δ for distant vision and of 30 Δ for near vision, with a left hypertropia of 10 Δ. The hypertropia increased with the eyes turned up and to the left, or with paralysis of the right inferior oblique. The convergence near point was not well held, so a resection of the right externus and a recession of the left superior rectus were performed. These procedures produced a good cosmetic result.

Case 10.—K. McT., aged 6½, was seen on March 10, 1931. Vision was 20/20 in the right eye and 20/15 in the left eye with glasses, which had a correction of +2.75 +0.50 cyl. 105° for the right eye and of +2.25 +0.50 cyl. 90° for the left eye. There was an exophoria of 10 Δ without glasses, which was changed to an exotropia with the correction. The right hyperphoria was 3 Δ with the eyes in the primary position, and increased to 35 Δ with the eyes up and left. With the eyes down and left, the right hyperphoria was 5 Δ.

The diagnosis was paralysis of the left superior rectus with a secondary deviation of the right inferior oblique. A slight secondary contracture of the right inferior rectus was advised at once, but was postponed. One year later the right hyperphoria had increased to 7 Δ with the eyes in the primary position, to 40 Δ with the eyes up and left and to 20 Δ with the eyes down and left. Within one year the left inferior rectus had shown a decided secondary contracture. The right inferior oblique was operated on at this time.

One week after operation there was a right hyperphoria of 2 Δ, which increased to 10 Δ with the eyes up and left, but none elsewhere. One month later there was no hyperphoria in any field, owing, no doubt, to the subsidence of the secondary contracture of the left inferior rectus. On Feb. 20, 1933, there was no deviation for distant vision and less than 1 centrad of esophoria for near vision (screen test). The screen-Maddox rod test with the rod before either eye showed no hyperphoria, nor was there any in either the upper or the lower corner by the screen test, any secondary contracture present having entirely disappeared.

MIXED (TERATOID) TUMORS OF THE LACRIMAL CARUNCLE

DERRICK T. VAIL, JR., M.D
CINCINNATI

Considering that the lacrimal caruncle and semilunar fold are derived from ectodermal and mesodermal tissues, and further that they are bathed in secretions, physiologic and often pathologic, exposed to trauma and irritation and subject to disease processes and inflammatory agents affecting the adjacent structures, it is surprising to find so few case reports of tumors of this region.

Swelling or tumors of the caruncle were observed by the ancients. Galen gave the name "encanthis," a term which Paul of Aegina (625-690) defined as an "extuberance of the natural flesh." Wilhelm Fabry of Hilden (1560-1624) restricted this term to neoplasms of the caruncle. Marchetti (1589-1673) made some observations, and Scarpa (1747-1832) some good clinical studies, of this condition. Midlemore, in 1840, discussed tumors of the caruncle, and in the first volume of von Graefe's *Archives für Ophthalmologie* one finds an article by the immortal master himself on "Tumors of the Lacrimal Caruncle." Parsons (1904), La Grange (1906), Beauvieux (1913), Morax (1926) and Serra (1928) wrote comprehensively on this subject, especially the latter, who collected and recorded all the case reports to 1928 and wrote what amounts to a monograph on this topic.

All writers agree that tumors of the caruncle are exceedingly rare. Wätzold saw only 6 cases among 60,000 patients, and I have seen 1 in 15,000 patients. Serra collected 136 cases in the literature including 3 of his own. Morax never saw a primary malignant tumor of this organ.

It is not within the scope of this paper to do more than mention briefly the various types of tumors found in the caruncle.

Beauvieux, adopting La Grange's classification, compiled a useful table, based on the evolution of the tumors rather than on malignancy or nonmalignancy.

Serra's (1928) collection is as follows: epithelioma, 20 cases; sarcoma, 11; melanoma, 13; fibroma, 10; polyp, 1; angioma, 10; papilloma, 21; adenoma, 9; dermoids, 6; dermoid cyst, 1; mixed tumors, 5; simple hypertrophy, 9; lymphoma, 1; granuloma, 8, and simple cysts, 11.

Read before the Section on Ophthalmology at the Eighty-Fourth Annual Session of the American Medical Association, Milwaukee, June 15, 1933.

Since Serra's work, the following additional case reports can be added: sarcoma (Alexiadès), granuloma telangiectaticum (Scheerer), melanoma (Chapman) and angioma (Bardanzellu).

Swelling of the caruncle simulating tumors occurs chiefly as a result of inflammatory processes: (*a*) symptomatic or functional encanthis (de Schweinitz), (*b*) chancre of caruncle (6 cases reported to 1912, Jampolsky), (*c*) foreign bodies (Bock, 1905), (*d*) hyaline or amyloid tumor (Schreiber) and trachoma (Baquis).

REPORT OF CASE

H. M., a salesman, aged 24, consulted me on Feb. 18, 1930, complaining of a growth at the inner corner of the right eye, which he had noticed for many years, but which had increased rapidly in size during the preceding three weeks. Since 1923 he had observed a single large hair in the center of the growth. There had

Evolution of Tumors (by Beauvieux)

Tumors of Epithelial Origin		Tumors of Conjunctival Origin		Mixed Tumors	
Benign Evolution	Malignant Evolution	Benign Evolution	Malignant Evolution	Benign Evolution	Malignant Evolution
Adenoma	Epithelioma	Fibroma	Sarcoma	Simple hypertrophy	Simple hypertrophy
Simple cysts	Carcinoma	Hyaline tumors	Lymphosarcoma	Simple hypertrophy	Simple hypertrophy
Papilloma	Papilloma	Angioma	Melanotic sarcoma	Papillary telangiectatic fibroma	Papillary telangiectatic fibroma
Papillomatous polyps	Papillomatous polyps	Lymphangioma	Lymphangioma	Dermoid cysts	Dermoid cysts
Granuloma	Granuloma	Lymphoma	Lymphoma	Dermoid cysts	Dermoid cysts

never been any interference with lacrimal function or signs of inflammation in or around the swelling or any history of bleeding.

Examination revealed a firm, nontender, glistening, reddish, sessile tumor, sharply outlined, with rounded edges, attached to the lateral margin of the caruncle by an intimate adhesion forming a sulcus between the caruncle proper and the growth. The lateral margin and part of the superior margin of the growth were free of the conjunctiva, and one could pass a small spatula under the growth, toward the inner canthus, for about 3 mm. The tumor measured approximately 10 by 8 by 4.5 mm. (excised specimen, fig. 1). A single cilium was seen springing from its anterior surface. It was of about the same size and thickness as the cilia of the upper lid, and was quite different from the fine hairs which are usually found in the caruncle. As can be seen from the photograph, there was no eversion of the lower punctum. There was no discharge. A diagnosis of dermoid tumor was made.

Cocaine anesthesia (5 per cent solution) was used, and the lateral edge of the tumor was grasped with flat forceps and a blunt dissection of the underlying surface made. The growth was easily freed and, as it turned out, little of the conjunctiva was removed. The attachment to the caruncle was then incised medially to the sulcus. The tumor was removed and a part of the caruncle, about two-thirds

Fig. 1.—Mixed tumor of the caruncle. Note the sulcus between the tumor and the caruncle proper.

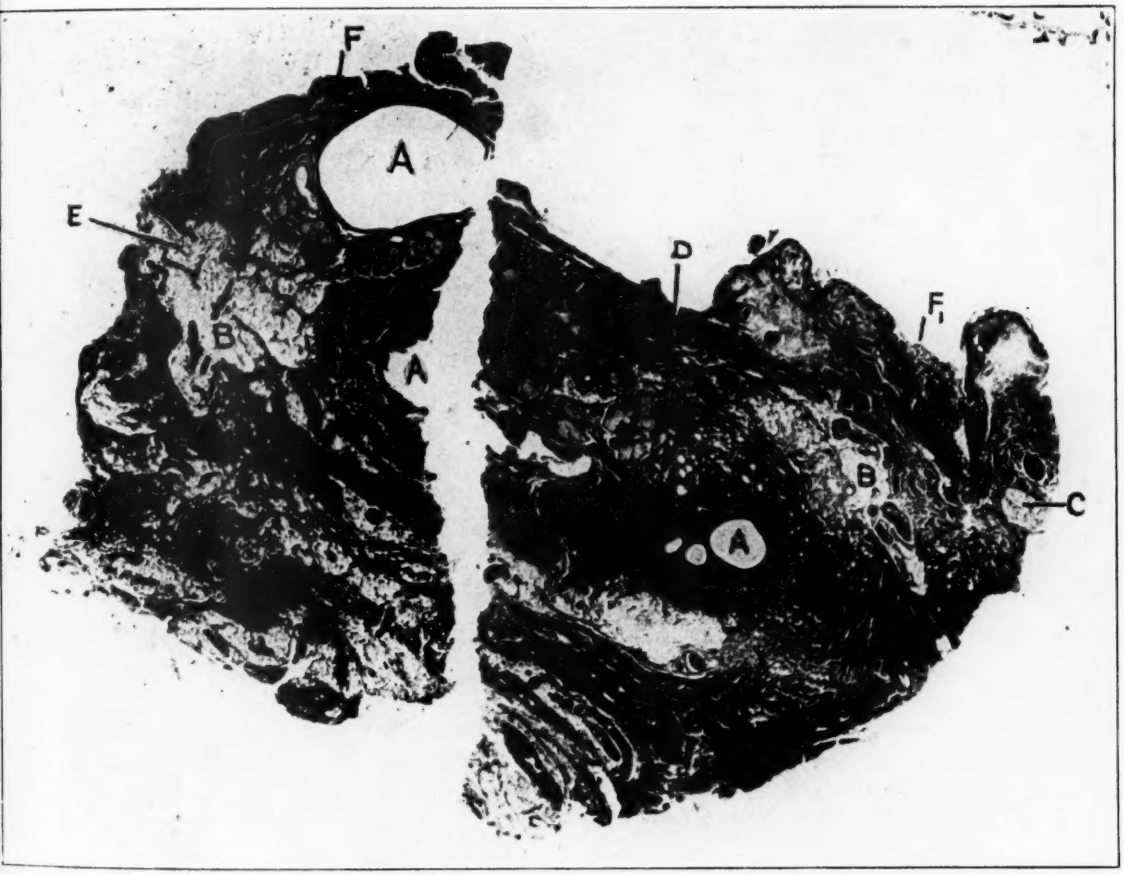


Fig. 2.—Low power photomicrograph of the entire tumor through its widest portion. *A* indicates a sebaceous cyst, surrounded by round cell and foreign body giant cell infiltration; *B*, fat; *C*, smooth muscle; *D*, hair follicles; *E*, lakes of blood; *F*, papillary epithelium, and F_1, epithelium with many goblet cells.

the size of the caruncle in the other eye, was left. The edges of the conjunctiva were undermined and united with two fine silk sutures. Healing was uneventful. The sutures were removed on the third day, and the patient was discharged on the fifth day. The cosmetic result was good.

The excised specimen was fixed in a dilute solution of formaldehyde, U. S. P. (1:10) embedded in paraffin and sectioned serially. A section was sent to Dr. Frederick H. Verhoeff of Boston, who examined it and reported that it con-

Fig. 3.—High power section through a sebaceous cyst showing foreign body giant cells.

tained "fibrous tissue, adipose tissue, smooth muscle, sebaceous glands and hair follicles. In one place there is a multilocular sebaceous cyst within it which has given rise to an inflammatory reaction and foreign body giant cells, the reaction being analogous to a chalazion." He also stated that he had no specimen in his collection exactly like this, but that he had two smaller specimens of the same general nature, and added that a sebaceous cyst surrounded by an inflammatory reaction with many foreign body giant cells was not an uncommon picture in teratoid tumors.

One can readily identify these structures in the photomicrograph (fig. 2), so that a long description is unnecessary. It is noteworthy, however, to observe the

large amount of fibrous tissue, the many and large blood vessels and certain "lakes" of blood present in the specimen. The surface epithelium was papillomatous in places and contained many goblet cells. The epithelium lining the sebaceous cyst (which contains cellular and granular débris) was made up of a single layer of square basal cells and approximately five layers of flat cells, the top layer of which contained granules. No evidence of malignancy was observed in any of the various cellular elements. A letter from the patient almost exactly three years after the operation stated that he had had no recurrence of the growth and had had no further trouble.

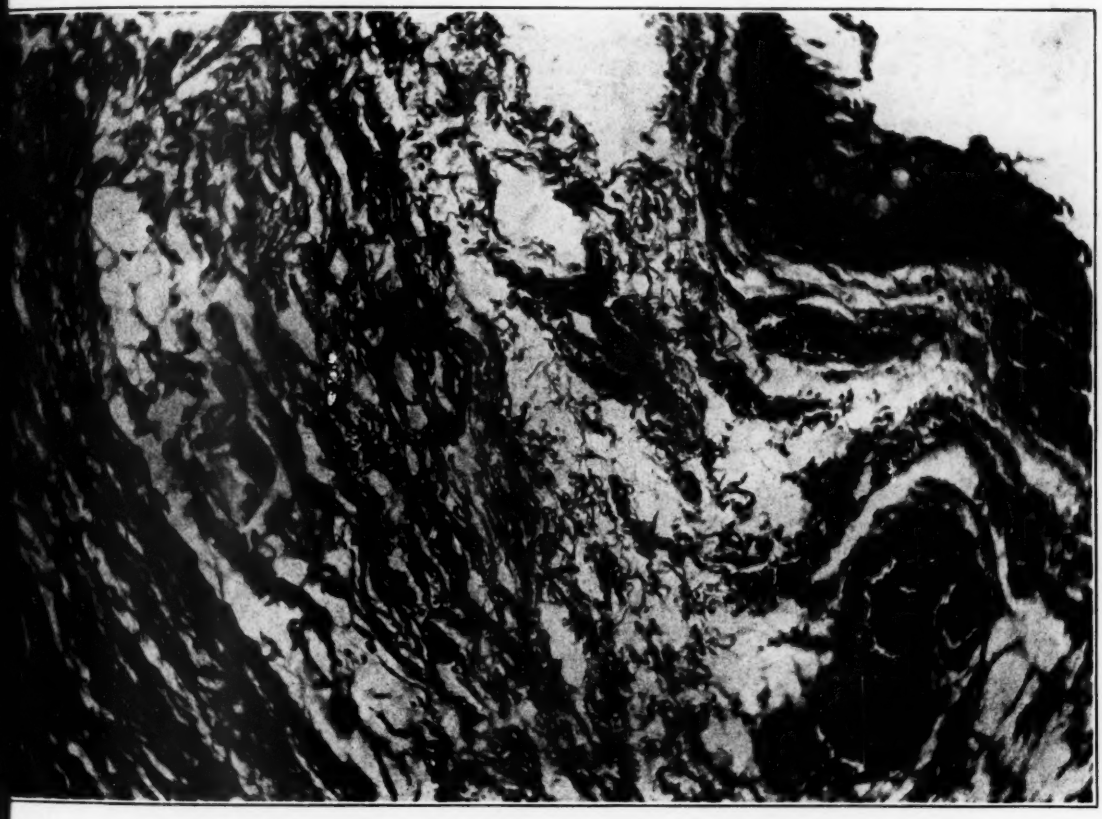


Fig. 4.—High power section through the glandular epithelium showing goblet cells, many blood vessels, loose connective tissue and firm connective tissue.

COMMENT

"The term 'mixed tumors,'" quoting Ewing, "is confined to comparatively simple, chiefly embryonal growths, of purely local origin, resulting from overgrowth of embryonal structures with or without displacement. Most of the accepted forms of mixed tumors do not contain derivatives of three germ layers, but are bidermal or monodermal. Mixed tumors are closely related in origin to the simple embryonal tumors occurring in many regions."

Serra collected what he decided were 5 cases of mixed tumor in the literature. It seems best to quote this part of his article in full:

According to Barbacci the class of mixed tumors includes essentially those types of tumors which are the result of simultaneous blastomatous proliferation of diverse tissues derived almost exclusively from a single blastodermal layer, but also from more than one germinal layer.

While the tissues which simultaneously begin blastomatous proliferation all belong to the connective tissue series, in this connection one speaks more particularly of *mixed connective tissue tumors;* if, however, epithelial tissues are also proliferating nearby, one has *mixed connectivo-epithelial tumors.*

Barbacci then subdivides these neoformations into mixed tumors of the ubiquitous type (those which take origin in any organ and region of the body without modifying their fundamental characteristics in any way) and mixed tumors of regional type (forms which are closely connected with the locality in which they arise and are only found in that region).

Mixed tumors of the lacrimal caruncle are all of the ubiquitous type.

CASES COLLECTED FROM THE LITERATURE (QUOTED FROM SERRA)

De Wecker (1862).—This writer describes a tumor of the caruncle, pedunculated, which had developed rather slowly. On microscopic examination it was found to be covered with stratified pavement epithelium, and to consist of a fibrous connective tissue network infiltrated with numerous lymphoid cells and containing ectatic arterial and venous vessels in great abundance and cysts lined with goblet cells. Diagnosis: cystic fibrosarcoma of the lacrimal caruncle, or evolving cystic fibroma.

Collica-Accordino (1879).—Boy of 5, with a tumor of the caruncle which, within 3 or 4 months, had reached the size of a nut, and extended almost as far as the canthus minor, displacing the right eyeball upward and outward; on its surface one noted small eminences with crusts. After removal, the tumor branched out to the internal and lower wall of the eyeball, and had become so extensive after three months that the patient was dismissed as inoperable. Microscopic examination of the neoformation resulted in the diagnosis of telangiectatic fibrosarcoma; it consisted of fasciculated connective tissue with foci of fusiform cells at some points, and elsewhere isolated or confluent small round cells; there were numerous vessels of varied caliber, distributed particularly at the periphery, which gave the tumor a cavernous appearance.

Despaguet (1888).—Woman of 30, tumor of the left caruncle, which was the cause of profuse hemorrhages. On histologic examination it was found to be covered with rather thick pavement epithelium from which, at one point, there extended a branched epithelial plug. It was formed for the most part of a very great number of small, elongated, angulated cells, placed contiguous to each other, almost without interposition of supporting tissue, and of numerous, very full, ectatic blood vessels, either communicating with each other or not, and located particularly in the deeper part of the tumor. Diagnosis: fasciculated sarcoma. According to Mantey and Blum, however, it should be considered an angiosarcoma.

Königshofer and Lepmann (1903).—Angiosarcoma of the lacrimal caruncle which also extended to the surrounding subconjunctival tissue.

Wätzold (1913).—Fibro-adenoma of the lacrimal caruncle.

Undoubtedly there have been other cases of tumors described by various authors as simple hypertrophy, fibroma, fibro-adenoma and

telangiectatic fibroma which can be classified as mixed tumor from the histologic pictures and Ewing's definition. Beauvieux, however, put it more simply and understandably when he said that he meant by the term "mixed tumor" a growth of the caruncle in which one finds that the conjunctival tissue participates in the same degree as epithelial tissue. His case of papillary telangiectatic fibroma parallels in some of its details those of my case.

BEAUVIEUX'S CASE.—A man, aged 28, noticed a growth in the inner canthus of the right eye for one year. It was the size of a large pea and obviously hypertrophied. It was located between the two palpebral edges and by its contact everted the lacrimal puncta, causing persistent epiphora. The tumor developed rapidly. Two large papillary eminences separated by a deep ravine were observed. The tumor was made up of much adult fibrous connective tissue disposed in bundles, more or less dense, in which were great numbers of little vessels, the largest of which was well formed and the smallest composed of endothelial cells only. In one of the papillary processes the vessels were not so numerous but consisted of blood "lakes."

Von Graefe's case is also somewhat similar. He observed, during a year, a hazelnut-sized tumor of the caruncle which had a sharp border. It was located on the anterior surface of the caruncle and was covered with smooth red mucous membrane. Microscopically, it was found to be rich in fibrous tissue and blood vessels. Von Graefe made a diagnosis of fibroma.

Rados, discussing fibroma of the caruncle, remarked that a study of the collected cases (4) shows the following clinical characteristics: The tumors grow slowly over a long period, then suddenly become large. They are located directly on the caruncle, attached to it only by a small band. There is no spontaneous bleeding. The tumors are rose red and well defined, reach the size of a pea or hazelnut and are smooth and somewhat elastic to touch. They do not recur after removal. Histologically, a fibroma is rich in connective tissue and reveals many blood vessels and lymph channels. This description aptly fits my case.

Bock described a tumor which he diagnosed as a fibroma or lipofibroma, consisting of dense fibrous tissue, with fat, elastic tissue, medullated nerves, unstriped muscle and sebaceous glands. A few hairs were present. The epithelium was partly a single layer of cylindric cells and partly two or three layers of large cubical cells, with many goblet cells. Bock had observed this tumor in a man, 23 years old, for three years. The patient had noticed it for many years. One and a half years after Bock had first seen the patient, the growth was increased in size. At the time of excision, it was pea-sized, blood red and horseshoe-shaped. The surface was smooth and shiny, and the border was well defined, free and firm. There was no recurrence.

Parsons, commenting on the foregoing case, said: "This tumor may have been a mere hyperplasia or fibrolipoma as described by the author. There is no indisputable case of dermoid (of the caruncle) published."

Berl reported a case of dermoid cyst of the caruncle measuring 9 by 10 mm. in a man aged 47. It was free except at the inner canthus and was attached to the nasal side of the punctum of the upper lid. It contained hair follicles and stratified and horny epithelium.

Green described a case of sebaceous cyst of the caruncle which, however, can scarcely be classified as a mixed tumor.

All authors believe that these tumors are of congenital origin and most of them believe that symptoms or irritation (epiphora and inflammation) are the results and not the causes of growth, but that mechanical irritation, trauma or inflammation may cause the tumor to take on a sudden growth, just as in the case reported.

BIBLIOGRAPHY

Alexiadès: Primary Sarcoma of Lacrimal Caruncle and Plica Semilunaris, Arch. d'opht. **48**:341, 1931.

Baquis, M.: New Contribution to the Knowledge of Neoplasms of the Lacrimal Caruncle and Plica Semilunaris, Lettura oftal. **5**:324, 1928.

Bardanzellu, T.: An Interesting Case of Angioma in the Region of the Nasogenic Angle of the Lower Lid, Caruncle and Semilunar Fold, Arch. di ottal. **36**:68, 1930.

Beauvieux: Tumors of the Lacrimal Caruncle and Semilunar Fold, Arch. d'opht. **33**:216 and 1913. (Bibliography.)

Berl, V.: Tumors of the Lacrimal Caruncle, Beitr. z. Augenh., 1901, p. 47; abstr., Ann. Ophth. **10**:624, 1901.

Bock, E.: Contribution on the Pathologic Anatomy of Lacrimal Caruncle, Klin. Monatsbl. f. Augenh. **24**:487, 1886.

Chapman, V. A.: A Case of Melanoma of Caruncle, Am. J. Cancer **16**:645, 1932.

Collica-Accordino, V.: Fibrosarcoma Telangiectastia of the Lacrimal Caruncle, Ann. di ottal. **8**:250, 1879.

Despaguet, F.: Malignant Tumors of the Caruncle, Rec. d'opht. **10**:33, 1887.

Ewing, James: Neoplastic Diseases; Treatise on Tumors, ed. 3, Philadelphia, W. B. Saunders Company, 1928, p. 1017.

Fabry, Wilhelm, cited by La Grange.

von Graefe, A.: Tumors of Lacrimal Caruncle, Arch. f. Ophth. **1**:289, 1854.

Green, J. F.: Cysts and Cystic Tumors of the Caruncle, Arch. Ophth. **51**:145, 1922. (Bibliography.)

Jampolsky, F.: Chancre of Lacrimal Caruncle, Wien. klin. Wchnschr. **26**:669, 1913.

Königshofer and Lepmann: A Case of Angiosarcoma of the Caruncle, Jahresb. f. Ophth., 1903, p. 214.

La Grange, in La Grange, F., and Valude, E.: Encyclopédie française d'ophtalmologie, Paris, O. Doin, 1906, vol. 5, p. 601.

Marchetti, cited by La Grange.

Midlemore, cited by Morax.

Morax, Victor: Cancer de l'appareil visuel, Paris, O. Dion, 1926, p. 192. (Bibliography.)

Parsons, J. H.: The Pathology of the Eye, New York, G. P. Putnam's Sons, 1904, vol. 1, p. 147.

Paul of Aegina, cited by Hirschberg: History of Ophthalmology in Graefe-Saemisch: Handbuch der Augenheilkunde, Leipzig, Wilhelm Engelmann, 1899, vol. 12, p. 380.

Rados, E.: On the Pathologic Anatomy of the Caruncle Lacrimalis, Klin. Monatsbl. f. Augenh. **50**:338, 1912.

Scarpa, cited by La Grange.

Scheerer, R.: Granuloma Telangiectaticum of the Caruncular Region and Lacrimal Sac, Klin. Monatsbl. f. Augenh. **86**:445, 1931.

Schreiber, L.: On the Pathology of the Conjunctiva, Arch. f. Ophth. **84**:420, 1913.

de Schweinitz, G. E., cited by Green.

Serra, G. M.: Tumors of Lacrimal Caruncle: Clinical, Anatomopathologic and Statistical Study, Boll. d'ocul. **7**:783, 1928. (Complete bibliography.)

Wätzold: Tumors of the Lacrimal Caruncle, Zentralbl. f. prakt. Augenh. **37**:42, 1912.

de Wecker, L.: Treatise of Ophthalmology, Paris, 1880; cited by Serra.

ABSTRACT OF DISCUSSION

DR. THOMAS D. ALLEN, Chicago: It is always interesting to determine whether or not the mass is malignant, and if it is, its relative malignancy. Because of the rarity of such tumors, I recently visited the Army Museum in Washington and found they had records of 5 such cases and sections of 4 of these.

Dr. E. C. Ellett, Dr. J. N. Greear and Dr. Jonas Friedenwald have given me permission to review their cases and show their slides.

Dr. Ellett's case was that of a woman, 39 years of age, who had noticed the growth for ten years. It consisted of a reddish mass lying between the cornea and caruncle, with a hair growing from the center. It was about 6 by 6 by 2 mm., firmly adherent to the conjunctiva and loosely attached to the sclera. It was removed in July, 1928, and when the patient was last seen in October, 1928, the eye was in good condition.

The report of the pathologist, Dr. Friedenwald, was: "The tissue consists of a mass of fibrous tissue and fat with a small piece of overlying epithelium." The slide shows a good deal of fat in well developed lobules—a sort of lipomatous overgrowth.

Dr. Greear's case was a melanoma of the plica semilunaris of one year's duration, which had increased in size during the six months preceding removal. The section contains many chromatophores with considerable melanin, and large vessels. Such a picture is often seen in sections of relatively benign melanoma of the skin.

In one slide is shown a cystic basal cell carcinoma without many mitotic figures —a growth of low grade malignancy.

In the next slide are seen cartilage and a good deal of glandular tissue. This may recall the fact that in the lower animals the nictitating membrane often contains cartilage.

In another slide a fibrous polyp covered with squamous epithelium is seen.

Tumors containing sebaceous glands in this region are not frequent. A slide shows hyperplasia of sebaceous gland cells, and here and there evidence of chronic inflammation.

RETRACTION SYNDROME

RUDOLF AEBLI, M.D.
NEW YORK

The retraction syndrome is a name applied to a group of cases in which there is a congenital deficiency of motility of the horizontal recti muscles. Numerous isolated cases were reported in the nineties by Sinclair,[1] Türk,[2] Bahr,[3] Friedenwald[4] and Treacher Collins.[5] The first complete account was presented by J. Wolff,[6] who described the symptoms more accurately and more fully than had been done before and also gave a well considered presentation of the different theories to explain the retraction. Duane[7] collected 54 cases and described the syndrome and its varied picture in such detail that practically nothing new has been added. Recently Bielschowsky[8] reported 68 cases and again stressed the varied and complex picture which this group of congenital muscular anomalies presents.

This group of cases is characterized by all or some of the following peculiarities:

1. Complete or, less often, partial absence of abduction in the affected eye.
2. Partial, rarely complete, deficiency of adduction in the affected eye.
3. Retraction of the globe when the eye is adducted, rarely when it is abducted.
4. An oblique movement of the affected eye either up and in or down and in when the impulse to adduct is exercised.
5. A narrowing of the palpebral fissure in adduction with a tendency to widen in abduction.
6. A paresis or marked deficiency of convergence, the affected eye remaining fixed in the primary position while the sound eye is converging.

The anatomic basis of these disturbances of motility has been established by both macroscopic and microscopic examination. Axen-

---

From the Muscle Clinic of Dr. James W. White, New York Post-Graduate Medical School and Hospital, Columbia University.

1. Sinclair: Ophth. Rev. **14**:314, 1895.
2. Türk, S.: Deutsche med. Wchnschr. **22**:199, 1896.
3. Bahr: Ber. u. d. Versamml. d. ophth. Gesellsch. **25**:334, 1897.
4. Friedenwald, H.: Bull. Johns Hopkins Hosp. **8**:135 and 202, 1896.
5. Collins, E. T.: Brit. M. J. **2**:846 (Sept. 30) 1899.
6. Wolff, J.: Arch. Ophth. **29**:297, 1900.
7. Duane, Alexander: Congenital Deficiency of Abduction, Arch. Ophth. **34**: 133, 1905.
8. Bielschowsky, A.: Motilitätsstörungen der Augen, in Graefe-Saemisch: Handbuch der gesamten Augenheilkunde, Leipzig, Wilhelm Engelmann, 1932, vol. 8, pt. 2, chap. 11, p. 353.

feld [9] and Wolff [6] have demonstrated that there is more or less complete absence of muscular tissue and that the fasiculi of the muscles are replaced by inelastic fibrous bands. The extent to which muscular tissue is replaced by fibrous tissue differs and accounts for the variations in adduction or abduction. Injuries sustained at birth have been reported in isolated cases, but most authors believe that they have no causal relationship. Anomalous insertions of the internal rectus by a broad fibrous band intimately attached to the sclera back of the equator have been reported. My associates and I have had a number of such cases, but believe that they are not cases of true retraction syndrome but belong to the group of strabismus fixus.

LIMITATION OF ABDUCTION AND ADDUCTION

Limitation of Abduction.—This is present in the majority of cases and is the most constant finding. Among the 172 combined cases of Duane,[7] Birch-Hirschfeld [10] and Bielschowsky [8] limited or complete loss of abduction was present in the left eye in 116 cases, in the right eye in 30 cases and in both eyes in 26 cases. The abduction is frequently greater when the gaze is directed up or down, and this is due, respectively, to the secondary abducting power of the inferior and superior oblique muscles. If the external rectus retains only a moderate abducting power in the horizontal plane, then the superior and inferior obliques will be able to reinforce it, and in such a case the power of outward movement in the upper and lower fields may be much better.

Limitation of Adduction.—This finding is not as constant as limitation of abduction and in most cases is not complete. Duane [7] reported it considerably diminished in 37 cases and absent in 8.

RETRACTION AND OBLIQUE MOVEMENTS

Retraction Movements.—Retraction movements varying from 1 to 10 mm. were reported in 41 of Duane's cases and in 33 of Bielschowsky's cases. These movements are exaggerated in adducting, and the recession increases with adduction. Associated with the recession is a narrowing of the palpebral fissure. Adduction, however, is not necessary, and a number of cases of retraction of the globe into the orbit have been reported in which there was a complete loss of adduction power. In some cases the eye has a sunken appearance in the primary position; in the majority of cases the enophthalmos is not marked in this position. Rarely does one see retraction of the globe in abduction.

9. Axenfeld, T.: Beitrag zur Kenntnis der angeborenen Beweglickeitsdefekte der Augen, Klin. Monatsbl. f. Augenh. **39**:64, 1901.

10. Birch-Hirschfeld, A., in Graefe-Saemisch: Handbuch der gesamten Augenheilkunde, Leipzig, Wilhelm Engelmann, 1932, vol. 9, pt. 1, chap. 13, p. 220.

Numerous theories have been proposed to explain this peculiar phenomenon from which the syndrome has derived its name. Heuck [11] thought that the tendon of the internus was inserted too far back, so that it acted to pull the eye not only inward but also backward. Bahr [3] reported a case in which the internus had a second slip, inserted far back, and acted as a retractor while the main body of the muscle acted as an adductor. Treacher Collins [5] supposed that there was in addition a deficiency of the check ligaments. Wolff's [6] theory is that the retraction is due simply to the inextensibility of the externus. Under ordinary circumstances, as the internus contracts the externus elongates, so that the eye rotates about its center. If the externus fails to elongate, the internus can adduct only if the eyeball recedes. In those cases in which the internus has no power of adduction, it has been supposed that the retraction is caused by the superior and inferior recti, which, acting vicariously as adductors, contract very strongly and in so doing pull the eye back into the orbit. It is likely that the cause of the retraction is not the same in all cases, and, as in all congenital anomalies, one must always be on the lookout for variations.

Oblique Movements.—A deviation of the affected eye, most often up and in, less frequently down and in, is seen in attempted adduction. This is present in the majority of cases and frequently produces a disfiguring upshoot. Various explanations have been offered to account for these vertical movements. Wolff explained them on a mechanical basis and suggested the hypothesis that as the eyeball recedes into the orbit it displaces the orbital contents, and as the optic nerve, at its point of attachment, offers a resistance to the backward movement of the globe, the tendency will be for the globe to rotate up if this point of resistance is below the horizontal plane and to rotate down if this point of resistance is above the horizontal plane. Duane [7] did not agree with this view and thought that the upshoot was due to an excessive spasmodic contraction of the inferior oblique. He believed that the overaction of the obliques was compensatory, and stated that the abducting action of the obliques was called into play to an excessive degree to replace, as well as may be, the defective action of the externus. He cited a number of cases in which the abduction was markedly increased in eyes turned straight up or down, and pointed to these as proof that the obliques were overacting. Another explanation is that the internus is attached abnormally high, and that it acts not only as an adductor but also as an elevator. Here, again, it is likely that the upshoot is caused by a variety of abnormal conditions and that one explanation is not sufficient to cover all cases.

---

11. Heuck: Klin. Monatsbl. f. Augenh. **17**:256, 1879; cited by Kuhn and Türk.

NARROWING OF THE PALPEBRAL FISSURE

A complete or partial closure of the palpebral fissure is present when the affected eye is adducted. The narrowing of the fissure is not a ptosis but is due to a contracture of the orbicularis. It probably is due to a peculiar synergic action of the facial and third nerves. Such contractions of the palpebral fissure during associated lateral movements of the eye have been reported by Wilbrand and Saenger.[12] In abduction there is frequently a widening of the palpebral fissure. These findings may be reversed. Duane [7] reported a case in which the fissure narrowed on abduction and widened on adduction.

INSUFFICIENCY OF CONVERGENCE

The ability to converge varies greatly with the direction of the visual gaze. If directed away from the side of the insufficient internus, the eyes converge quite well. Even if esotropia is present in the primary position, the convergence near point may be remote. If an operation on the internus is contemplated, one must be cautious not to weaken it still more if the relative or absolute near point of convergence is remote.

The objective symptoms enumerated constitute the characteristic features. Others of more or less significance are the relative frequency in women, the preponderance in the left eye and the absence of pupillary or accommodative involvement. In the primary position there may be orthophoria, esotropia or exotropia. The gaze is usually directed toward the side of the unaffected eye. Thus, if there is convergence in the primary position, the head is usually turned toward the affected externus, and the gaze is directed in the opposite direction. This places the eyes in equilibrium, and often binocular vision is obtained in a narrow strip of the visual field.

The subjective symptoms are not marked. The vision in the affected eye may be poor, but in many cases it is normal. Spontaneous diplopia is occasionally troublesome, and the patient observes that diplopia occurs when he turns his head in certain directions. Diplopia can almost always be elicited with the red glass, and in cases in which there is fairly good sight one generally finds a narrow strip of true stereoscopic vision.

TREATMENT

The only treatment to be considered is surgical. In view of the pathologic condition which underlies most of these cases, advancement by an increase in the tension and, hence, in the retraction might do more harm than good. Patients who have esotropia with the eyes in the pri-

12. Wilbrand, H., and Saenger, A.: Die Neurologie des Auges, Munich, J. F. Bergmann, 1900, vol. 1.

mary position, with a good relative near point of convergence and with the head turned toward the affected externus, are helped by a moderate recession of the internus. This procedure often eliminates the disfiguring turn of the head by shifting the strip of binocular vision toward the affected side. Patients with a marked vertical upshoot may be helped by tenotomy of the inferior oblique. In cases in which the eye diverges in the primary position and in which the externus is replaced by a rigid, inextensible band, an operation for lengthening this band may be serviceable. Transplantation of bands of muscle from the superior and inferior recti has been suggested, but we do not favor this operation. The operative findings vary considerably, and it is a good plan to expose the muscles and see exactly with what one has to deal. Occasionally it is better judgment to stop the operation and merely close the conjunctival incisions. In general, one must be reluctant to operate on patients with these congenital anomalies.

REPORT OF CASES

CASE 1.—The patient had a unilateral left-sided retraction syndrome, with enophthalmos in the primary position, marked retraction of the globe and narrowing of the palpebral fissure on adduction, complete loss of abduction and an oblique upward movement of the left eye. Vision in the right eye was 20/20; that in the left eye was 20/25. There was no spontaneous diplopia, but with a red glass diplopia could be elicited. No operation was advised as we thought that any attempt to shorten the externus would increase the enophthalmos and also the retraction.

CASE 2.—A bilateral retraction syndrome was present, with normal vision in each eye and a strip of true stereoscopic vision in the primary position. With the eyes turned to the right, there was a loss of abduction, with retraction of the left globe and narrowing of the left fissure. With the eyes turned to the left, there was a partial loss of abduction with a moderate retraction of the right globe. The head was turned slightly to the more affected side (right), and the gaze was directed straight ahead, putting the eyes into equilibrium. There was no spontaneous diplopia; with a red glass homonymous diplopia was elicited when the eyes were turned to the right or the left; single vision was obtained when the eyes looked straight ahead.

CASE 3.—The patient had a unilateral left-sided retraction syndrome with a disfiguring upshoot in the primary position which increased when the eyes were turned to the right; there was complete loss of abduction when the eyes were turned to the left. Vision in the right eye was 20/20; the left eye was amblyopic. The left inferior oblique was tenotomized. This procedure had no effect on the upshoot, and only after the internus was receded did the upshoot disappear. In this case the vertical deviation was not due, as is generally believed, to an overaction of the left inferior oblique.

CASE 4.—The patient had a unilateral left-sided retraction syndrome, with preoperative left esotropia with the eyes in the primary position. The convergence near point was good. Vision was 20/20 in both eyes. There was almost complete loss of abduction with the eyes left. The head was turned to the left and the gaze directed to the right, putting the eyes into equilibrium. A recession of the

Fig. 1 (case 1).—Left retraction syndrome: *A*, enophthalmos with narrowing of the palpebral fissure in the primary position. *B*, retraction of the globe on adduction, with marked narrowing of the fissure. *C*, complete loss of abduction. *D*, vertical upshoot of the affected eye in adduction.

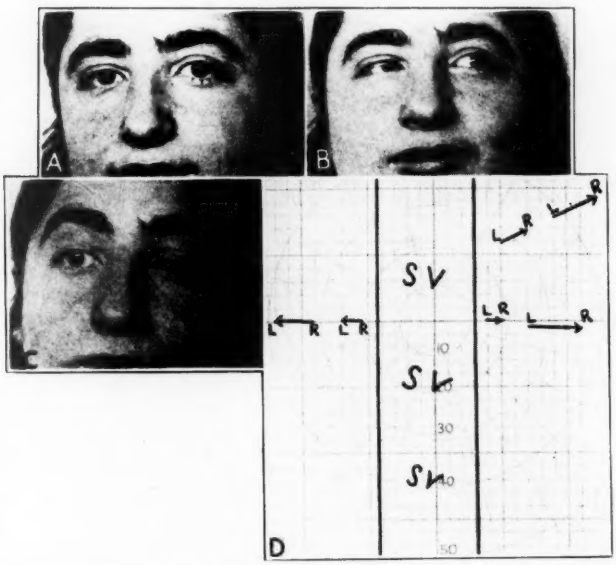


Fig. 2 (case 2).—Binocular retraction syndrome: *A*, eyes in equilibrium, head turned toward the right, gaze directed toward the left, into the field of binocular vision. *B*, moderate retraction of the right eye and partial loss of abduction of the left eye, with the eyes turned to the left. *C*, retraction of the left eye, narrowing of the left fissure and loss of abduction of the right eye with the eyes turned to the right. *D*, diplopia chart showing a strip of binocular single vision straight ahead, with homonymous diplopia increasing with the eyes turned right or left.

Fig. 3 (case 3).—Left retraction syndrome: *A*, marked left hypertropia in primary position. *B*, narrowing of the left fissure, retraction of the globe and vertical upshoot of the left eye in adduction. *C*, complete loss of abduction in the left eye. *D*, position of the eyes after tenotomy of the left inferior oblique and moderate recession of the left internus.

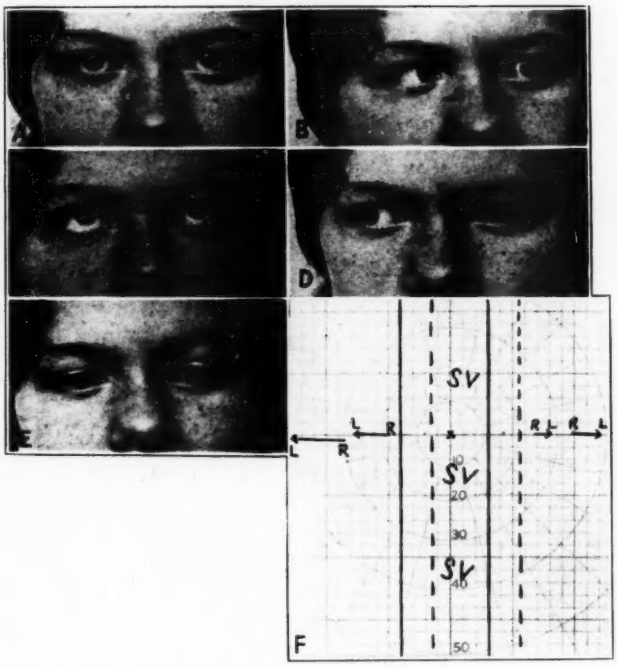


Fig. 4 (case 4).—Left retraction syndrome: *A*, position of the eyes after recession of the left internal rectus. *B*, loss of abduction in the left eye. *C*, normal elevation with the eye turned up. *D*, moderately good adduction with no retraction of the globe and no narrowing of the palpebral fissure. *E*, normal depression with the eyes turned down. *F*, dotted lines indicate the area of preoperative binocular single vision; solid line shows the area of postoperative single vision. Homonymous diplopia increasing with the eyes turned left; heteronymous diplopia increasing with the eyes turned right.

left internus was done. The area of single vision, as shown on the diplopia chart, was shifted to the left, and the disfiguring position of the head was thereby eliminated. The pictures were taken after operation, and the diplopia chart is a composite one, the dotted area showing the preoperative field of diplopia, and the solid area the postoperative field.

CASE 5.—Before operation we considered this case to be one of a bilateral retraction syndrome. With the eyes turned to the left there was a complete loss

Fig. 5 (case 5).—Strabismus fixus simulating binocular retraction syndrome: *A*, marked esotropia in primary position. *B*, eyes left, showing some retraction of the right globe, narrowing of the fissure and complete loss of abduction in the left eye. The left eye does not come to the midline. *C*, eyes right, showing retraction of the left globe, narrowing of the fissure and complete loss of abduction in the right eye. The right eye does not come to the midline.

Fig. 6 (case 6).—Left strabismus fixus: *A*, left eye fixed in the nasal field. *B*, position of the eyes after recession of a short, rigid, semifibrous internus. *C*, complete loss of abduction in the left eye—the eye does not come to the midline.

of abduction, with a retraction of the right globe and a narrowing of the right fissure. With the eyes turned to the right there was a loss of abduction, with a retraction and narrowing of the left fissure. Vision was 20/20 in both eyes. At operation we found a rigid, fibrous, short internus intimately attached to the globe at the equator, and a thinned-out externus containing considerable muscular tissue and little fibrous tissue. The loss of abduction was due to the inextensibility of the interni. In the light of these findings, the case is one of bilateral

strabismus fixus and not one of a true retraction syndrome. Both interni were carefully tenotomized and the external conjunctival incisions closed. The patient now has moderately good adduction, and the cosmetic result was good.

CASE 6.—The patient had marked left esotropia with the eyes in the primary position, with complete loss of abduction in the left eye, the eye being fixed in the nasal field and not coming out to the midline. This is an intermediate case between a retraction syndrome and a strabismus fixus. At operation a rigid fibrous internus intimately attached to the globe near the equator was found. The externus was replaced by a thin fibrous band containing no muscular tissue. The internus was receded 3 mm.; nothing was done to the externus. A moderate esotropia is still present; the eye now comes out to the midline. We plan to weaken the internus more at a later period, but believe that caution is necessary, for if the internus is completely severed all horizontal movements of the left eye will be lost and it will be immobile.

METASTATIC CARCINOMA IN BOTH OPTIC NERVES SIMULATING RETROBULBAR NEURITIS

T. L. TERRY, M.D.
AND
E. B. DUNPHY, M.D.
BOSTON

When carcinoma metastasizes to the eye the choroid is usually affected. In 1872, Perls [1] reported the first authenticated case of choroidal metastasis, the primary growth having been in the lung. In 1926, Clapp [2] collected one hundred and eighteen cases of metastatic carcinoma of the choroid, and since then several other cases have been reported. The intra-ocular metastases usually arise from a carcinomatous breast, lung, uterus or prostate. In some cases the choroidal involvement has extended back into the optic nerve. In the cases reported by Saxer,[3] Marchand [4] and Cords,[5] the meninges of the brain were involved with metastatic growth which extended into the optic nerve sheaths.

In the cases reported by Schöler [6] and Uhthoff,[7] there were retrobulbar metastases which enveloped the optic nerve.

Metastasis to the optic nerve or to its sheaths is rarely found. A search of the literature reveals only five cases of this condition (Elschnig,[8] Ginsberg,[9] Holden,[10] Behr [11] and Goldstein and Wexler [12]).

The case of Goldstein and Wexler is interesting. The patient was a man of 48 with carcinoma of the stomach and evidences of numerous metastases. The fundi were normal, and so far as could be ascertained,

---

From the Massachusetts Eye and Ear Infirmary and the Department of Ophthalmology, Harvard Medical School.

1. Perls: Virchows Arch. f. path. Anat. **56**:305, 1872.
2. Clapp, C. A.: Am. J. Ophth. **9**:513, 1926.
3. Saxer: Verhandl. d. deutsch. path. Gesellsch. **5**:161, 1902.
4. Marchand: München. med. Wchnschr. **13**:636, 1907.
5. Cords: Ber. ü. d. Versamml. d. deutsch. ophth. Gesellsch. **43**:293, 1922.
6. Schöler: Centralbl. f. prakt. Augenh. **7**:236, 1883.
7. Uhthoff, W.: Internat. Beitr. z. wissensch. Med. Festschr. R. Virchow **2**: 423, 1891.
8. Elschnig, A.: Arch. f. Augenh. **22**:149, 1891.
9. Ginsberg, S.: Klin. Monatsbl. f. Augenh. **67**:232, 1921.
10. Holden, W. A.: Arch. Ophth. **31**:427, 1902.
11. Behr, C.: Klin. Monatsbl. f. Augenh. **69**:788, 1922.
12. Goldstein, Isadore, and Wexler, David: Metastasis in the Sheath of the Optic Nerve from Carcinoma of the Stomach, Arch. Ophth. **6**:414 (Sept.) 1931.

there were no visual disturbances before death. At autopsy the right optic nerve showed extensive infiltration of the arachnoid with tumor cells, the nerve itself remaining intact. The authors concluded that the growth in the nerve sheath is compatible with the absence of papilledema or other ophthalmoscopic signs if the growth is gradual and the intracranial portion of the optic nerve is free.

In all the other cases there were visual disturbances and some ophthalmoscopic signs.

REPORT OF A CASE

History.—L. J. B., aged 27, an American mechanic, was admitted to the Massachusetts General Hospital on Aug. 13, 1928, complaining of left frontal headache, pain in the left side of the chest and blindness.

Five weeks before admission he had an attack of grip which confined him to bed for two weeks. A persistent cough developed, with pain in the left side of the chest, radiating up to the left shoulder.

Three weeks prior to admission he noticed failing vision in the left eye. The eye became blind in one week, and the right eye then began to fail. Within two weeks his vision was nil in each eye. About this time deafness developed in the left ear, and he noticed numbness on the left side of the nose and the lower part of the spine.

His grandmother died of cancer.

The patient had the usual diseases of childhood. He was subject to attacks of bronchitis. He drank occasionally and smoked one package of cigarets a day.

Examination.—The pupils were dilated and showed no reaction to light. Vision in both eyes was nil. Both disks were hyperemic, with slightly blurred margins on the right, but no elevation. The retinal vessels were normal. The ophthalmoscopic picture was that of acute retrobulbar neuritis. Examination of the reflexes showed normal knee jerks. The neck was stiff, and a moderate Kernig sign was present. The abdominal reflexes were present.

Roentgen examination showed the sinuses clear; the sella turcica was not well shown.

The hemoglobin was 95 per cent; the white blood cell count was 10,250. A smear was normal. The Wassermann and Hinton tests gave negative results.

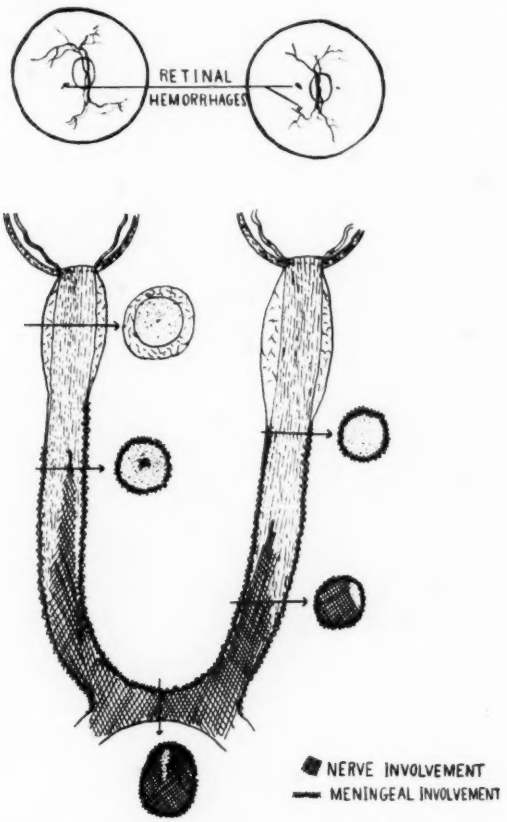
Examination of the chest revealed consolidation of the upper lobe of the left lung, with coarse, mottled dulness through the right pulmonary field. The heart was not displaced. The temperature ranged between 98 and 100 F. The pulse rate was irregular; the respiratory rate varied from 20 to 28. Signs pointed to pneumonic consolidation with coarse râles and tactile fremitus. The sputum was negative. A guinea-pig into which sputum was injected showed no evidence of tuberculosis at autopsy.

Lumbar puncture revealed : fluid, clear; cells, 82; alcohol, 3+; ammonium sulphate, 1+; sugar, 58 mg.; chlorides, 684 mg.; Wassermann reaction, negative; total protein, 300 mg.; initial pressure, 155; compression of the right jugular vein, 200 systolic and 150 diastolic; compression of the left jugular vein, 240 systolic and 160 diastolic; colloidal gold curve, 1111232110.

Course.—The patient died on September 10, twenty-eight days after admission. During the course of the illness there were hemorrhages in both retinas. There was never any discernible elevation of the disks.

Necropsy.—Postmortem examination (at the Massachusetts General Hospital) revealed general carcinomatosis with involvement of the lungs, liver, kidneys, spleen, thoracic and abdominal lymph nodes, meninges of the base of the brain, midbrain and floor of the fourth ventricle. The primary lesion of the carcinoma was suspected to be in the lungs.

The posterior half of each eyeball, the optic nerves and the chiasm were removed and sent to the pathologic laboratory of the Massachusetts Eye and Ear Infirmary for examination.



Diagrammatic sketch of the involvement of the optic nerves.

Gross examination showed one small retinal hemorrhage near the disk in one eye and two similar ones in the other eye. There was no gross evidence of papilledema. Just behind the globes the optic nerves showed slight fusiform swelling over an area about 12 by 18 mm. The optic nerves were sectioned at about intervals of 3 mm.; each segment was fixed in formaldehyde (10 per cent) and embedded in celloidin. From a study of the slides it was possible to reconstruct the full extent of the involvement, as shown in the accompanying figure.

The pathologic changes consisted in:

1. The optic chiasm, optic nerves and their meninges were infiltrated with metastatic carcinoma. The cellular make-up was consistent with a primary growth in the lungs.

2. Near the globe, the intervaginal spaces were greatly enlarged. This produced the swelling as noted in the gross description. The reason for limitation of the swelling was obvious in that the carcinoma had almost completely obliterated the intervaginal space posterior to the distention.

3. There was slight papilledema of too small a degree to be diagnosed grossly.

4. There were several very small hemorrhages into the nerve fiber layer of the retinas.

COMMENT

There was a rapid growth of the carcinoma in the optic chiasm, the optic nerves and the meninges, giving a clinical picture of retrobulbar neuritis. The blindness must have been produced by a rapid destruction of the fibers of the optic nerves and chiasm. Unequal involvement of the two nerves explains the poor vision in the left eye sooner than in the right eye. The late occurrence of a very small amount of papilledema does not necessarily mean absence of increased intracranial pressure until late, since the partial obliteration of the intervaginal space could have prevented equalization of the intracranial and intervaginal pressures. The case was considered worthy of reporting, since carcinomatous involvement of the optic nerve producing a picture of acute retrobulbar neuritis is not found in the literature.

VISUALIZATION OF FOREIGN BODIES IN THE IRIDOCORNEAL ANGLE

A SIMPLE METHOD OF STEREOSCOPIC GONIOSCOPY

GORDON M. BRUCE, M.D.
NEW YORK

A foreign body in the angle of the anterior chamber of the eye is usually well seen, or its presence may be suggested by the signs of its entry or by the roentgen picture. Sometimes, however, leading signs may be absent, and a foreign body caught in the angle may be invisible by ordinary means. In such cases the use of some form of gonioscopy is indispensable. Various methods may be employed.

Trantas,[1] since 1898, has been bringing the angle into the field of an ophthalmoscope by means of firm pressure over the limbus with a transilluminating apparatus or even with the finger. By this means he has been able to visualize the angle [2] and to make observations on the canal of Schlemm [3] and the ora serrata.[4] This method, however, gives but an imperfect view. It is difficult for the physician and at best highly

---

From the Department of Ophthalmology, College of Physicians and Surgeons, Columbia University.

1. Trantas, A.: Moyens d'explorer par l'ophtalmoscope—et par translucidité—la partie antérieure du fond oculaire, le cercle ciliaire y compris, Arch. d'opht. **20**:314, 1900; Sur la gonioscopie (ophtalmoscopie de l'angle irido-cornéen), Arch. d'opht. **45**:617, 1928. (Here the author states that he has done gonioscopy for twenty-nine years.)

2. Trantas, A., in discussion on Gallemaerts: Examen microscopique des affections de la cornée au moyen de la lampe à fente, Bull. et mém. Soc. franç. d'opht. **39**:20, 1926 (especially pp. 31 and 32); Corps étrangers de la région ciliaire et rétrociliaire constatés par la pression digitale et diaphanoscopique, Folia opht. orient. **1**:61, 1932.

3. Trantas, A.: L'ophtalmoscopie de l'angle irido-cornéen (gonioscopie): Conclusions à en tirer pour la nature du canal de Schlemm, Arch. d'opht. **36**:257, 1918-1919.

4. Trantas, A.: Excroissances de l'ora-serrata et leur aspect ophtalmoscopique, Clin. opht. **12**:115, 1906; discussion, p. 119; Ophtalmoscopique de la région ciliaire et retrociliaire, Arch. d'opht. **27**:581 and 650, 1907 (especially pp. 589 and 590); Ophtalmoscopie de la région ciliaire et rétrociliaire, Bull. et mém. Soc. franç. d'opht., 1907, p. 546; discussion, pp. 591 and 592, especially pp. 554 and 555; 589 and 590; Utilisation du microscope de Czapski pour la gonioscopie et pour la cycloscopie (ou gonioscopie postériure), Bull. Soc. d'opht. de Paris, 1930, p. 345.

uncomfortable to the patient. In certain conditions, such as iridocyclitis or detachment of the retina, it may be painful or even dangerous.

Mizuo,[5] in 1914, drew attention to the fact that the lower angle could be brought into view by instilling water into the culdesac and pulling the lids away from the globe. This method has the advantage of simplicity, but it can be applied only to visualization of the lower angle, and the image is small and distorted.

Salzmann[6] is the father of gonioscopy as it is known today. In 1913, he conceived the idea of applying the contact glass of Fick to the patient's cornea and examining the angle with the ophthalmoscope. The image so seen is somewhat indistinct and rather small, but the method was by far the best developed to that time.

Koeppe[7] designed a larger contact glass than that used by Salzmann. He illuminated the angle by reflecting light from the slit lamp by means of mirrors. The stereoscopic image so obtained is large and clear, but only the lateral angle can be visualized, and the technic is extremely difficult.

The most important contribution to the subject was made by Troncoso, who, incidentally, is responsible for the word "gonioscopy." He used the Koeppe contact glass, but incorporated the source of light in an ingenious instrument which can be used from all sides to inspect any part of the angle.[8] This is the best of the methods in general use,

---

5. Mizuo: Ein Verfahren zur Besichtigung der Kammerbucht, abstr., Klin. Monatsbl. f. Augenh. **52**:561, 1914.

6. Salzmann, M.: Die Ophthalmoskopie der Kammerbucht, Mitt. d. Vereines d. Arzte in Steiermark **50**:305, 1913; Die Ophthalmoskopie der Kammerbucht, Ztschr. f. Augenh. **31**:1, 1914; Die Ophthalmoskopie der Kammerbucht, ibid. **34**:26, 1915; Nachtrag zu Ophthalmoskopie der Kammerbucht, ibid. **34**:160, 1915; Die traumatische Cyclodialyse und ihre Diagnose am Lebenden, Arch. f. Ophth. **105**:551, 1921 (especially pp. 554 and 555).

7. Koeppe, L.: (*a*) Ueber den derzeitigen Stand der Glaukomforschung an der Gullstrandschen Nernstspaltlampe sowie den weiteren Ausbau der Glaukom-Frühdiagnose vermittelst dieser Untersuchungsmethode, Ztschr. f. Augenh. **40**: 138, 1918-1919; (*b*) Die Theorie und Anwendung der Stereomikroskopie des lebenden menschlichen Kammerwinkels im fokalen Lichte der Gullstrandschen Nernstlampe, München. med. Wchnschr. **66**:708 and 798, 1919; (*c*) Die Mikroskopie des lebenden Kammerwinkels im fokalen Lichte der Gullstrandschen Nernstspaltlampe, Arch. f. Ophth. **101**:48 and 238, 1919-1920; (*d*) Das stereo-mikroskopische Bild des lebenden Kammerwinkels an der Nernstlampe beim Glaukom, Klin. Monatsbl. f. Augenh. **65**:389, 1920; (*e*) Die Mikroskopie des lebenden Auges: Die Mikroskopie des lebenden vorderen Augenabschnittes im natürlichem Lichte, Berlin, Julius Springer, 1920, vol. 1 (especially p. 44).

8. Troncoso, U. M.: Gonioscopy and Its Clinical Applications, Am. J. Ophth. **8**:434, 1925; Gonioscopy in Glaucoma, in Contributions to Ophthalmic Science, Dedicated to Dr. Edward Jackson on his Seventieth Birthday, Menasha, Wis., George Banta, 1926, pp. 74-86; The Physiologic Nature of the Schlemm Canal, Am. J. Ophth. **4**:321, 1921 (especially p. 325).

but stereoscopic vision is not possible. The apparatus is expensive. The technic, while not particularly difficult, is not easy, and few observers have been able to acquire the remarkable facility of Dr. Troncoso in handling the instrument.

Comments on these and allied methods have been written by Ascher,[9] Dimmer,[10] Meesmann,[11] Nordenson,[12] Thorburn,[13] Castresana[14] and Mawas.[15]

It is seen that there is need for a quick and simple method for visualizing the angle of the chamber. The following procedure, which fills the requirements, was demonstrated in 1932 by Castroviejo.[16] The contact glass of Koeppe is placed in the phenacainized eye, which is then perfused with saline solution.[7b] A beam of light from an electric ophthalmoscope (from which the head has been removed) is then directed toward the angle to be examined. Through the slit-lamp binocular, detached and held in the other hand, an excellent view of the angle may now be obtained (fig. 1). How effective this procedure may be is illustrated by the following case:

A 28 year old woman complained that ever since a motor accident six years before, when she was thrown through the windshield, her right eye had suffered from attacks of iritis. These would recur at intervals of from three weeks to four months, and would last from two to six weeks, subsiding under the administration of atropine and the application of hot compresses. A roentgenogram of the globe and orbit had been negative, and physical examination had revealed no focus of infection. The right eye showed marked circumcorneal injection which was a little more severe in the lower half. There were a few old scattered posterior corneal deposits. The iris was inflamed, and the pupil dilated by atropine instilled before the patient arrived at the hospital. There was some scattered

---

9. Ascher, K. W.: Zur Mikroskopie des lebenden Auges (Bindehaut, Kammerbucht, Wärmeströmung), Klin. Monatsbl. f. Augenh. **72**:628, 1924.

10. Dimmer, F.: Der Augenspiegel und die ophthalmoskopische Diagnostik, ed. 3, Leipzig, Franz Deuticke, 1921 (especially pp. 204-211); Bericht über die deutsche ophthalmologische Literatur: Untersuchungsmethoden (I. und II. Semester 1913), Ztschr. f. Augenh. **32**:156, 1914 (pp. 156-158 devoted to Salzmann's article on p. 1 of vol. 31).

11. Meesmann, A.: Die Mikroskopie des lebenden Auges an der Gullstrandschen Spaltlampe mit Atlas typischer Befunde, Berlin, Urban & Schwarzenberg, 1927 (especially pp. 134-138; also 24 and 70).

12. Nordenson, J. W.: Gonioskopie und Glaukomtheorien, Upsala läkaref. förh. **33**:407, 1927-1928.

13. Thorburn, T.: A Gonioscopical Study of Anterior Peripheral Synechiae in Primary Glaucoma, Svenska läk.-sällsk. handl. **53**:252, 1927.

14. Castresana, A.: La observación bio-micro-estereoscópica del ángulo irideocorneal, Siglo méd. **79**:293 and 326, 1927.

15. Mawas, J.: Biomicroscopie de la chambre antérieure, de l'iris et du corps ciliaire, Paris, Masson et Cie, 1928, p. 44; Gonioscopie ou étude de l'angle de la chambre antérieure, in Atlas de biomicroscopie oculaire, Paris, Masson et Cie, 1926.

16. Castroviejo, R.: Personal communication to the author.

pigment on the anterior capsule of the lens. The interior was normal. Tension was 18. The visual fields were normal. Under the slit lamp the palisades around the lower third of the cornea were seen to be greatly dilated, and the possibility of a foreign body in the inferior angle was considered. By the usual means of investigation nothing could be seen in this situation, nor could any trace of a

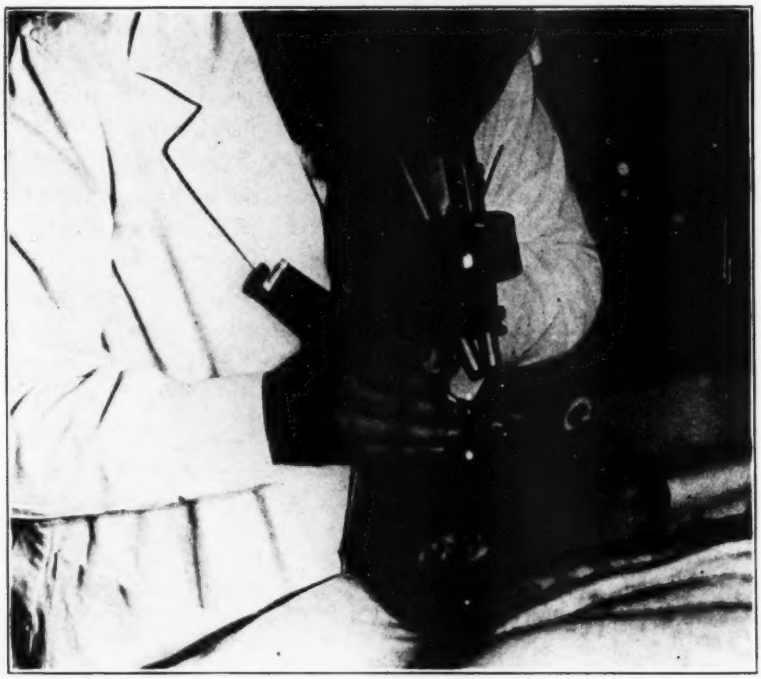


Fig. 1.—Position for visualizing the lower angle.

Fig. 2.—Sliver of glass in the lower angle. On the left the point of entry is indicated by a scar, to which the iris is adherent by a minute anterior synechia.

wound be discovered. Under hot compresses the eye became quiet in a few days, and ten days later the pupils were regular, active and equal. Pilocarpine was then instilled into the right eye, and the eye was examined by the technic described. A wedge of glass about 0.5 by 3 mm. in size was found to be lying in the angle

of the anterior chamber below, extending from 5:30 to 6:30 o'clock. Just medial to the nasal or sharp end was seen a minute scar in Descemet's membrane, and adherent to this a small anterior synechia. A tiny mass of white exudate was seen just under the medial end of the sliver (fig. 2).

A roentgenogram made by the Sweet method was negative, but after using the Vogt technic, Dr. Pfeiffer reported as follows:

"Stereoroentgenograms of the right orbit fail to show the presence of a foreign body. Examination of films of the anterior segment of the right eye taken by the Vogt technic reveals the presence of a small radiopaque foreign body. This measures less than 1 mm. in the two diameters shown in these films. It is

Fig. 3.—Roentgenogram of the foreign body in the anterior chamber.

Fig. 4.—Sliver of glass after removal. It has been dipped in methylthionine chloride, U.S.P. (methylene blue) for purposes of contrast in photography.

thought to lie directly posterior to the limbus below at 6 o'clock and either in the iris or slightly anterior to it. Our belief is that it is not metallic" (fig. 3).

The patient was admitted to the hospital for operation. It was felt that if an iridectomy were performed in the extreme periphery below, the glass might be withdrawn with the iris. An incision somewhat like that done in the Lagrange operation was made with the Wheeler knife in the extreme periphery extending from 5 to 7 o'clock. The iris was drawn forward and a piece excised. This failed to show the foreign body in its folds, so the wound was enlarged laterally with scissors, the corneal flap lifted upward, a spatula cautiously inserted, and the glass lifted through the wound (fig. 4).

Recovery was uneventful. The media now, six months after operation, are clear. Vision is 20/15 without correction, and there has been no recurrence of the iritis.

SUMMARY

1. Foreign bodies in the angle of the anterior chamber may be invisible by ordinary methods of examination.

2. The usual methods of visualizing the angle are either unsatisfactory or difficult to carry out.

3. A simple technic for performing gonioscopy is described, and a case illustrating its use is described.

NATIONAL SOCIETY FOR THE PREVENTION OF BLINDNESS

A LAY MOVEMENT FOR THE CONSERVATION OF VISION

WILLIAM CAMPBELL POSEY, M.D.
RADNOR, PA.
AND
LEWIS H. CARRIS
NEW YORK

Many members of this Section are undoubtedly familiar with the work of the National Society for the Prevention of Blindness; to them this paper will serve as a timely review of the aims, policies and activities of the organization. Those members who are unacquainted with it will be interested to learn of the volunteer organization that acts as a liaison agent between the medical profession and the public for the dissemination and interpretation of scientific procedures for the prevention of blindness and the conservation of vision.

The National Society is a lay organization and is maintained entirely by voluntary subscriptions. Its constituency is nation-wide, and donations of any amount are welcomed. The Society derives no support from foundations, and it does not solicit funds from members of the medical profession, as it is felt that physicians make their contributions in the form of medical research as well as free service to patients who are not in a position to pay.

The financial affairs of the Society are conducted conservatively. Up to the time of diminishing returns owing to the economic depression, a modest reserve had been accumulated from legacies, special gifts and current income. This reserve has enabled the Society so far to meet the deficit in the budget caused by the decreased contributions.

THE SOCIETY'S DIRECTORATE

The control of the National Society is vested in a Board of Directors consisting of thirty men, ten of whom are elected for periods of three years at each annual meeting of the Society held usually in November or December. As at present constituted, of the thirty members, the following nine are ophthalmologists:

Dr. Ellice M. Alger, New York
Dr. Conrad Berens, New York

Read before the Section on Ophthalmology at the Eighty-Fourth Annual Session of the American Medical Association, Milwaukee, June 16, 1933.

Dr. Colman W. Cutler, New York
Dr. Edward F. Glaser, San Francisco
Dr. T. B. Holloway, Philadelphia
Dr. Park Lewis, Buffalo
Dr. William Campbell Posey, Philadelphia
Dr. John M. Wheeler, New York
Dr. William H. Wilmer, Baltimore

There is also one obstetrician:

Dr. J. Clifton Edgar, New York

There are two doctors of medicine engaged in public health work:

Dr. A. J. Chesley, State Health Officer of Minnesota
Dr. William F. Snow, General Director of the American Social Hygiene Association

The remaining eighteen members of the Board are public-spirited citizens representing many fields.

In addition to the Board of Directors, there is an Advisory Committee consisting at the present time of twenty-one members. The ophthalmologists serving on this committee are:

Dr. Frank Allport, Chicago
Dr. E. V. L. Brown, Chicago
Dr. H. Dickson Bruns, New Orleans (deceased)
Dr. G. E. deSchweinitz, Philadelphia
Dr. John Green, St. Louis
Dr. LeGrand H. Hardy, New York
Dr. Harvey J. Howard, St. Louis
Dr. Walter B. Lancaster, Boston
Dr. W. H. Luedde, St. Louis
Dr. F. J. Pinkerton, Honolulu
Dr. Lawrence T. Post, St. Louis
Dr. Walter H. Snyder, Toledo
Dr. William H. Wilder, Chicago
Dr. Harry V. Würdemann, Seattle
Dr. Arthur M. Yudkin, New Haven

OBJECTS OF THE SOCIETY

The objects of the Society as stated in its By-Laws are:

1. To endeavor to ascertain, through study and investigation, any causes, whether direct or indirect, which may result in blindness or impaired vision.
2. To advocate measures which shall lead to the elimination of such causes.
3. To disseminate knowledge concerning all matters pertaining to the care and use of the eyes.

A consideration of these objects makes it clear that the Society is not in any sense engaged in the practice of ophthalmology, nor is it prepared to undertake any research projects of an ophthalmologic nature. The Society is fundamentally a lay organization, the activities of which are based on approved teachings of the medical profession,

particularly of ophthalmologists. Its responsibility is to secure such scientific knowledge regarding the prevention of blindness and conservation of vision as is susceptible of sociologic interpretation, and to promote such social action, whether by private or by public agencies, as will enable the person to prevent ocular difficulties whenever this is possible and to receive necessary care and treatment when ocular troubles exist.

COOPERATION WITH OPHTHALMOLOGISTS

Whatever progress the Society has made in popularizing sound ophthalmologic practices has been due to the consistent interest on the part of ophthalmologists themselves in this work. From communications, personal contacts in the field and ophthalmologic meetings attended by staff members, it is evident that ophthalmologists are gaining increased knowledge of the Society's work and regard it with approval. The following are examples of the cooperation maintained in this field:

1. Securing approval from ophthalmologists of recommendations and material offered by the Society in its work.
2. Calling conferences of representative ophthalmologists to discuss proposed activities.
3. Preparing and distributing literature of particular interest to ophthalmologists.
4. Enlisting the cooperation of ophthalmologists in the advancement of certain projects for the prevention of blindness, such as the establishment of sight-saving classes and the promotion of medical social service in clinics for ocular diseases.
5. Providing stereopticon slides and moving picture films for use by ophthalmologists in their lecture and teaching work.
6. Supplying information and statistical data from the Society's files for the use of ophthalmologists in the preparation of papers.
7. Preparing and exhibiting material for national and state medical associations.
8. Attending ophthalmologic meetings on invitation.

A formal relationship between the medical profession and the Society has been maintained for several years through a special committee representing the Section on Ophthalmology of the American Medical Association, the American Ophthalmological Society and the American Academy of Ophthalmology and Oto-Laryngology which was appointed to cooperate with the Society. The committee consists of Dr. Thomas B. Holloway, Dr. William H. Luedde and Dr. William C. Finnoff.

Although it relies on the ophthalmologic profession for its scientific information and definitely recommends that all matters dealing with the eyes should be cared for by ophthalmologists, it is not the policy of the National Society for the Prevention of Blindness to take a positive

stand against optometry. Its literature and information service are, of course, available to optometrists and optical manufacturers just as to other interested persons. The Society is inclined to deplore the exaggerated emphasis sometimes placed on making the public eyeglass conscious. At times, also, it has been disturbed by the confusion which occurs in the public mind because of the existence of agencies established to further the commercial interests of optical concerns; when such agencies are masked under an altruistic name, they appear to be working in the public health field on the same basis as the Society. However, it has been found that such organizations, lacking sound policies and principles, are likely to be short-lived.

SUMMARY OF SOCIETY'S PROGRAM

Space will not permit an extended account of the major activities of the Society. They may be summarized as follows:

1. *Preventing infantile blindness:*

(*a*) by educating the public to the need for using prophylactic drops in the eyes of the new-born, and by endorsing legislation making such prophylaxis mandatory;

(*b*) by promoting and financing an inquiry into the best methods of providing prophylactic drops, i. e., wax ampules, the eye-dropper and other means;

(*c*) by educating the public to the necessity for prenatal care to avoid the development of ocular difficulties or blindness from syphilis.

2. *Care of the eyes of preschool children:*

(*a*) through education of parents, educators and others as to the importance of securing prompt ophthalmologic care for cases of squint and other ocular defects of young children;

(*b*) by developing and demonstrating throughout the country a technic for testing vision and inspection of the eyes to discover persons who should be referred for examination by ophthalmologists.

3. *Prevention of accidents to the eyes in childhood:*

(*a*) by educating parents regarding the dangers of fireworks, explosives, firearms and other things;

(*b*) by encouraging legislation limiting their sale.

4. *Conserving the sight of school children:*

(*a*) by developing and distributing to school and health administrators suggestions for a program of ocular health;

(*b*) by its advisory service to state and local education departments on specific problems related to programs for care of the eyes;

(*c*) by supplying to teachers and public health nurses at a nominal cost pamphlets and Snellen vision test cards for use in their work;

(*d*) by presenting the need for special "sight-saving" classes for children with seriously defective vision; by encouraging state legislation to provide financial support and administrative help for such special classes;

(*e*) by assisting in the establishment and conduct of training courses for teachers of sight-saving classes.

5. *Conserving the sight of the worker:*

(*a*) by developing and distributing a program of safety and care of the eyes in industry;

(*b*) by endorsing and contributing to the educational programs of national, state and local safety organizations as related to eyes;

(*c*) by supplying information and advice on problems related to ocular safety, lighting and other matters in industry.

6. *Publishing and distributing material:*

On various aspects of the conservation of vision of interest to the general public as well as to workers in the health and educational fields. The publications include a quarterly magazine, called *The Sight-Saving Review*, which carries articles and notes of value to physicians, educators, illuminating engineers, public health administrators, safety engineers and all others concerned with the sociologic aspects of saving sight.

7. *Research and demonstration projects:*

The projects that the Society has undertaken have naturally varied from year to year. The limits of this paper will permit only brief mention of some of the more outstanding activities undertaken in the past and those at present under way:

(*a*) The National Society has at intervals of about five years made a study of state legislative provisions for the prevention of ophthalmia neonatorum, under the auspices of the State and Provincial Health Authorities of North America.

(*b*) It secures annually from the American Foundation for the Blind figures showing the causes of blindness among pupils in schools for the blind and is at present cooperating with that organization in the sponsorship of a committee charged with improving statistics of the blind.

(*c*) An evaluation of Snellen vision test charts available on the market has been made, and two charts (a letter and a symbol "E" chart) have been evolved embodying what seem to be the best features.

(*d*) As mentioned, the Society has developed an improved technic for laymen in testing vision of children too young to know their letters; this has been widely demonstrated and adopted. A statistical analysis of the findings of a thousand cases has been published as proof of the importance of routine testing for preschool children as a means of selecting those requiring ophthalmologic attention.

(*e*) The Society keeps a current census of sight-saving classes throughout the United States and in 1930 contributed to the White House Conference on Child Health and Protection an extensive study of all phases of sight-saving class work.

(*f*) For the past few years the Society has been carrying on a special project of demonstrating the value of medical social ocular service in sight-saving and of training workers for such positions in hospitals.

COOPERATIVE ASPECTS OF SOCIETY'S PROJECTS

A description of the development of the project of medical social service for ocular diseases will serve as an illustration of the cooperative basis on which many of our activities are worked out. In 1928 the Society made an appropriation to enable the late Dr. George S. Derby to carry on at the Massachusetts Eye and Ear Infirmary a demonstration

of the value of medical social service in the treatment of glaucoma. When the demonstration began, 297 patients were taken over for supervision and treatment; at the end of 1931, 823 patients were on the follow-up list. It is felt that the medical social worker is particularly valuable in cases of glaucoma from the point of view of both the service to the patient and the assistance to the physician. It is also hoped that this study will have produced data that may be of importance in the medical and social evaluation of the disease and treatment.

As an outgrowth of this demonstration, the National Society undertook the training and placement of medical social workers for service in clinics and hospitals for ocular diseases by granting scholarships to the students and, at the beginning, by contributing part of the salary when the worker was placed. The value of this training and service is indicated by an increased demand for such workers, even in this period of depression, and by the participation of a second medical center in carrying a training course.

Wherever possible, cooperative efforts are carried on through a joint committee, through a special committee appointed by an agency or through conferences with representatives of organizations. An example of this type of cooperation is found in the publication of the pamphlet, "Conserving the Sight of School Children," which was prepared under the direction of the Joint Committee on Health Problems in Education of the American Medical Association and the National Education Association. The cost of printing and distributing two editions of this pamphlet has been borne by the Society; a third edition, with revisions, is now being considered.

Among the national agencies with which active cooperation has been carried on are:

National Organization for Public Health Nursing
Conference of State and Provincial Health Authorities of North America
American Social Hygiene Association
National Safety Council
National Rehabilitation Association
American Association of Hospital Social Workers
American Public Health Association
National Congress of Parents and Teachers
American Association of Instructors of the Blind
National Education Association
American Nurses' Association
International Council for Exceptional Children

Similar active cooperation has been maintained with state, city and local volunteer and public health groups.

Since preparing this paper it has been recalled that active cooperation has also been maintained with:

American Standards Association
American Federation of Labor
American Museum of Safety

The Society was active in the work leading up to the establishment of the International Association for Prevention of Blindness in The Netherlands in 1929, and has made a modest financial contribution to the Association's work each year.

It has not been the policy of the Society to set up state organizations which would be dependent on the National Society either for their charters or for financial support, nor has there been any obligation on the part of state societies to furnish financial support to the National Society. There are, however, three active local societies, the Illinois Society, the Maryland Society and the Louisiana Society. There are also a Committee on Prevention of Blindness of the Alabama State Medical Association and a Committee for Conservation of Vision of the Washington State Medical Society.

The National Society is a member of the National Health Council which aims to coordinate the activities of the affiliated groups in order to prevent overlapping and duplication of work. The other members of the Council are:

Active Members

American Child Health Association
American Federation of Organizations for the Hard of Hearing, Inc.
American Heart Association
American Public Health Association
American Social Hygiene Association
Conference of State and Provincial Health Authorities of North America
National Committee for Mental Hygiene
National Organization for Public Health Nursing
National Tuberculosis Association

Advisory Members

American Red Cross
United States Children's Bureau
United States Public Health Service

Associate Members

American Nurses' Association
Foundation for Positive Health

The Society is approved by the National Information Bureau, which investigates and evaluates all agencies appealing to the public for support.

Historically, the National Society for the Prevention of Blindness owes much of its impetus to the activities of the American Medical Association which, during the first decade of the present century, was particularly active in making an effective fight against blindness from ophthalmia neonatorum. In 1907 Dr. W. J. Mayo, president of the Association, appointed a special committee which enlisted the aid of the obstetricians and sanitarians of the country in the movement, and numerous addresses were given before medical societies in the various states. This resulted in the appointment of local committees to aid the fight on ophthalmia neonatorum, usually in connection with state or local medical societies. In 1910 the scope of the special committee of the American Medical Association was enlarged to include the prevention of blindness from other causes. This special committee prepared and distributed generally a number of valuable pamphlets on various phases of the subject.

The National Society itself is an outgrowth of a special state-wide committee on prevention of blindness of the New York Association for the Blind, established in 1908 and financed for some years by the Russell Sage Foundation. This committee subsequently became independent, and in 1915, through an additional grant from the Rockefeller Foundation, it merged with the American Association for the Conservation of Vision, forming the National Committee for the Prevention of Blindness. The name was changed to the National Society for the Prevention of Blindness in 1928.

ABSTRACT OF DISCUSSION

DR. WILLIAM H. WILDER: Chicago: In discussing this excellent paper, I should like to present to the Section a brief account of the organization and operation of the Illinois Society for the Prevention of Blindness.

The Society was organized in 1916 and is like the National Society in that it is largely a lay organization. Its objects are:

1. To educate the public on the necessity of the prevention of blindness.

2. To encourage legislation which will safeguard the eyesight of the citizens of Illinois, and aid in the enforcement of such laws.

3. To conduct research on which such legislation may be based.

4. To demonstrate methods of prevention of blindness.

In the last ten years we have completed four demonstration projects:

1. The examining of the eyesight of school children in the city of Chicago, taken over in 1927 by the Chicago Board of Health.

2. An hourly nursing service for ophthalmia neonatorum, which was passed over to the Chicago Board of Health in 1930.

3. A demonstration of what fine supervision could do for sight-saving classes in the city of Chicago, which was taken over by the Chicago Board of Education in the fall of 1932.

4. Control of trachoma. Demonstration surveys were made by us in 1920 and 1930, and in 1930 the State Department of Public Health took over a modest

program for the control of trachoma which we hope will be developed into something larger shortly.

In all of our surveys in down-state cities of Illinois we have turned over the work of selecting sight-saving cases to the local nurses and have trained them to locate these cases.

We have been responsible for two laws on the statute books of the State which will protect the eyesight of our citizens, the first an enabling act for sight-saving classes and the second a mandatory law on ophthalmia neonatorum.

It seems to me that every state in the Union should have some organization or commission whose object should be educational propaganda in regard to the prevention of blindness, and, if I may be allowed to make the suggestion, without any feeling or desire of criticism, could not the splendid National Society for the Prevention of Blindness expand its influence and scope of activity by forming organizations of this kind in every state? Probably within a few years after organization such societies would prove to be self-supporting financially, but until they are so, they should be able to look to a parent organization for material help and encouragement.

Dr. Conrad Berens: New York: Dr. Posey and Mr. Carris have performed a great service for the cause of preventive ophthalmology in their outline of the work carried on by the National Society for the Prevention of Blindness. We shall now be better able to cooperate in the work because we understand its great importance.

The objects of the Society have been clearly stated. It seems incredible, but it is true, that the first object is still incompletely answered, for no satisfactory classification of the causes of blindness is yet available, in spite of the vast amount of statistical data collected. These data have been of little value because they were obtained long after the onset of blindness, and because of the inadequacy of the examinations often made by inexperienced observers.

The continued cooperation of ophthalmologists in the promotion of social service and follow-up work in clinics and hospitals for ocular diseases is essential. There is no way in which they can do more to prevent blindness than by assuring continued treatment of ocular diseases which may result in blindness. Of these, glaucoma is one of the best examples.

Statistics of the Society in regard to ophthalmia neonatorum are enlightening. In 1908, when the Society was organized, 26.5 per cent of the children entering schools for the blind owed their misfortune to ophthalmia neonatorum. Seven years later the percentage had been reduced to 15.1, and today it is 7.

One of the most important tasks is the maintenance of cooperation with various agencies, for example, the American Public Health Association and the American Foundation for the Blind. The splendid cooperation obtained is due in no small measure to the untiring activity of Mr. Carris.

Dr. Posey and Mr. Carris drew no conclusions, but it seems to me that we are justified in concluding that the National Society is doing a splendid piece of work in preventive ophthalmology and in collecting data of value to ophthalmologists.

Dr. S. B. Muncaster, Washington, D. C.: We are now interested in getting a law passed to establish conservation classes in the District of Columbia. During the last year the Lions' Club committee has been before congressional committees, district commissions, the superintendent of public schools and other committees of interest. I believe that we shall get this bill through Congress in the coming year.

There are from two to eight conservation classes in twenty-five of the largest cities of the United States. Washington and Pittsburgh are the only cities that do not have these classes.

Congress has appropriated money to provide three teachers to teach conservation classes in the District of Columbia.

MR. LEWIS H. CARRIS, New York: I appreciate the kind things which Dr. Wilder and Dr. Berens have said about the work of the National Society. If the co-author of the paper, Dr. Posey, were here, he would tell you that Dr. Wilder's idea of forming state societies has been in his mind for a number of years. We worked out a plan in 1928-1929, but financial conditions have made it impossible to promote the organization of these societies. I may say that while we welcome a voluntary committee for the prevention of blindness, we believe that in the field of social work we cannot get effective organization for such a movement as this unless people can be secured who can devote their entire time to the work. As in any social movement in the state, it takes money to put across a program for the prevention of blindness. We shall be glad to send staff members to assist in the organization of a state committee or society. We hope in time to have many societies like the ones in Illinois and Maryland, because then the staff of the National Society can be reduced. We shall not be concerned about national support if local societies can be organized.

CHEMISTRY OF THE LENS

III. AUTOLYSIS OF THE LENTICULAR PROTEINS

ARLINGTON C. KRAUSE, M.D.
BALTIMORE

The autolysis of the proteins of the lens plays a definite and specific part in the process of cataract formation in certain diseases of the lens. The term autolysis may be defined as the autodigestion or hydrolysis of cellular protein by the proteolytic enzymes of the tissue. Normally, the body tissue and the lens are faintly alkaline, and the cellular proteolytic enzymes are more or less inactive, but if the tissue becomes sufficiently acid, the proteolytic enzymes begin to break down the protein. The autolysis may be initiated in the lens indirectly by a general acidosis, which may be produced through faulty metabolism in the body, or by a direct local acidosis of the lens or of the lenticular fibers. The acidosis may also arise from an inflammatory reaction of the interior of the eye, decreased permeability of the capsule and injury or death of the cells of the lens, which is caused by trauma, age, radiation, toxin and other factors. The proteolytic enzymes naturally occurring in the aqueous humor and arising from the death of the leukocytes, which have migrated into the inner chambers of the eye, are effective only after the capsule of the lens is opened or damaged sufficiently to permit these enzymes to attack the proteins of the lens.

The first distinct interest in proteolytic enzymes in relation to cataract was shown in 1911. Clapp [1] showed that part of the protein of the lens was hydrolyzed autolytically after the death of the cells. He believed that after injury of the lenticular fibers, the intracapsular enzymes broke up the protein into diffusible products and that the aqueous humor carried them away. The enzymes of the aqueous humor possessed only a secondary influence. Burdon-Cooper,[2] in 1914, also argued in favor of the hydrolysis of the proteins as a cause of cataract, based on the idea that the tyrosine found in the anterior chamber, after discission of the lens, came from the lens and that the enzymes came

From the Wilmer Ophthalmological Institute of the Johns Hopkins University and Hospital.

1. Clapp, C. A.: Liquefaction and Absorption of the Crystalline Lens and Its Possible Relation to Lenticular Opacities, Am. J. Ophth. **7**:131, 1924; The Autolysis of the Crystalline Lens: A Preliminary Report, J. A. M. A. **56**:807 (March 8) 1911.

2. Burdon-Cooper, J.: Pathology of Cataract: The Hydrolysis Theory, Ophth. Rev. **33**:129, 1914.

through the ciliary body. In 1914, Goldschmidt [3] also brought forth the suggestion that autolytic enzymes of the cell split the protein of the dead fiber into small soluble molecules, which escaped through the capsule of the lens and left the eye by the canal of Schlemm. It is well known that if the capsule is opened the enzymes of the aqueous humor aid the hydrolysis, and, apparently, paracentesis increases the amount of proteolytic enzymes in the anterior chamber. Labbé and Lavagna [4] reported that a cataractous lens contains more amino-nitrogen than a normal lens. Galante [5] found the rate of autolysis of the lens greater than that of the cornea or uvea, but less than that of the retina.

In this paper, the primary interest, however, is in the autolytic action of the proteolytic enzymes in the fibers of the lens on the lenticular proteins.

EXPERIMENTAL PROCEDURE

The lenses were aseptically removed from fresh bovine eyes, and the substance of the lens was separated from the capsule. To the substance of 150 lenses, sufficient distilled water was added to make 1,500 cc. of the mixture. The lenticular substance was then disintegrated by means of a mechanical stirrer. From the solution of lenticular protein, 10 cc. was taken and diluted with water to 100 cc., of which 25 cc. was used for the determination of the total amount of nitrogen. To 10 cc. of the solution of protein was added 10 cc. of a 20 per cent solution of trichloracetic acid; after filtering, 10 cc. of the filtrate was used to determine the peptone and nonprotein nitrogen. The protein from 10 cc. of the solution of lenticular protein was precipitated by tungstic acid, and 5 cc. of the filtrate was used for the estimation of the nonprotein nitrogen. The original solution, which was adjusted to p_H 7, was diluted ten times and then centrifugated to remove the albuminoid. The total amount of nitrogen of this solution subtracted from the total amount of nitrogen of the original solution gave the albuminoid nitrogen. After the albuminoid was removed, acetic acid was added to the original solution until the p_H was at the iso-electric point of the alpha-crystallin. The alpha-crystallin was centrifugated off, and the amount of nitrogen in the centrifugate was determined. The quantity of nitrogen of the alpha-crystallin was then easily calculated by difference. After the albuminoid and alpha-crystallin were removed, the 25 cc. of the solution was saturated with magnesium sulphate at 30 C. and then diluted to 50 cc. with a solution of saturated magnesium sulphate to remove the beta-crystallin. After the solution was filtered, the amount of nitrogen was determined. The amount of beta-crystallin and albumin was calculated by difference. The amount of nitrogen was determined in all cases by the Kjeldahl method.

After the lenticular solution was mixed with toluene, it was placed in a stoppered graduate, which was held in a water bath maintained at a constant temperature of 37 C. The toluene possessed sufficient bactericidal and bacteriostatic properties

---

3. Goldschmidt, M.: Der Mechanismus des Abbaus und der Resorption der Linse, Arch. f. Ophth. **88**:405, 1914; Der Mechanismus des Abbaus und der Resorption der Linse, München. med. Wchnschr. **61**:657, 1914.

4. Labbé, H., and Lavagna, F.: Sur la constitution chimique du cristallin normal et pathologique, Compt rend. Acad. d. sc. **180**:1186, 1925.

5. Galante, E.: Il decorso dell'autolisi nei diversi tessuti oculari, Ann. clin. med. e med. sper. **20**:73, 1930.

to prevent any bacterial growth of aseptically prepared lenticular protein. The p_H of the solution was adjusted by hydrochloric acid and sodium bicarbonate. The p_H of the solution was determined colorimetrically by the Clark and Lubs methods, and also electrometrically.

To a solution of lenticular extract, gelatin was added as a protein derivative. It increased the amount of peptone and albumin fractions in analysis on account of its reaction with the protein precipitants. To another solution, peptone was added for the same reason. It also increased the quantity of albumin, peptone and nonprotein nitrogen, because of the method of analysis.

COMMENT

Table 1 shows the effect of the anabolic process of autolysis which occurs when the lens is dying or dead. The death of the lenticular tissue

TABLE 1.—*Natural Autolysis at Natural* p_H

	Total Nitrogen in per Cent						
Days of Autolysis	Albuminoid Nitrogen	Alpha-crystallin Nitrogen	Beta-crystallin Nitrogen	Albumin Nitrogen	Peptone Nitrogen	Nonprotein Nitrogen	p_H
0	0.048	0.409	0.429	0.023	0.009	0.011	7.2
3	.....	.....	0.427	0.026	0.000	0.020	7.2
7	.....	.....	0.423	0.025	0.001	0.020	7.0
12	0.049	0.435	0.400	0.090	0.017	0.020	7.0
16	0.045	0.435	0.299	0.107	0.008	0.034	6.8
20	0.082	0.375	0.313	0.109	0.012	0.041	6.5
27	.....	.....	.....	0.113	0.004	0.053	6.3
32	.....	.....	.....	0.109	0.007	0.052	6.2
44	.....	.....	.....	0.105	0.011	0.048	6.2
52	0.089	0.373	0.232	.....	0.007	0.051	6.2
67	.....	.....	.....	.....	0.010	0.049	6.2
79	.....	.....	.....	.....	0.012	0.049	6.2

results in an exceedingly gradual shift from the natural p_H of from 7.4 to 7.2 to a p_H of from 6.2 to 6.0. On the alkaline side, as well as on the acid side, the alpha-protease of Hedin breaks down only simple protein derivatives, peptone and polypeptides to amino-acids. It is seen that the peptone, at p_H 7.2, diminishes, and the nonprotein nitrogen increases. The other proteins remain unchanged. At p_H 7.0 or less, the beta-crystallin and albumin are split into secondary proteins. There is no evidence as yet that the secondary albumin is the same as the original albumin of the lens, or that all or a part of the beta-crystallin is broken into fragments. However, beta-crystallin loses about one third of its sulphur in the process and still behaves in many ways like the original beta-crystallin. Both of the proteins derived from beta-crystallin possess smaller molecules. The alpha-protease of Hedin, also acting on the acid medium, hydrolyzes the secondary albumin into peptones and amino-acids. This process continues until an equilibrium is reached. If the products diffuse away, more of the proteins are hydrolyzed. Table 1 shows that the original and derived albumin is

increased five and a half times, and the nonprotein nitrogen about five times during the autolysis. Beta-crystallin is decreased to about one half of the original amount. There is a questionable slight increase of albuminoid at the expense of the alpha-crystallin.

TABLE 2.—*Autolysis at* p_H 6.7

	Total Nitrogen in per Cent					
Days of Autolysis	Albuminoid Nitrogen	Alpha-crystallin Nitrogen	Beta-crystallin Nitrogen	Albumin Nitrogen	Peptone Nitrogen	Nonprotein Nitrogen
0	0.135	0.336	0.486	0.048	0.007	0.013
2	0.129	0.345	0.494	0.036	0.009	0.015
6	0.125	.....	0.407	0.060	0.061	0.016
9	.....	.....	.....	0.071	0.032	0.018
15	.....	0.391	0.264	0.224	0.006	0.046
23	0.154	.....	0.239	0.221	0.002	0.053
36	.....	.....	.....	0.231	0.003	0.053

TABLE 3.—*Autolysis at* p_H 6.1

	Total Nitrogen in per Cent					
Days of Autolysis	Albuminoid Nitrogen	Alpha-crystallin Nitrogen	Beta-crystallin Nitrogen	Albumin Nitrogen	Peptone Nitrogen	Nonprotein Nitrogen
0	0.229	0.264	0.412	0.035	0.001	0.017
3	0.204	.....	.....	0.153	0.002	0.026
5	0.192	.....	.....	0.142	0.011	0.028
7	0.227	0.259	0.294	0.141	0.002	0.042
15	0.194	.....	.....	0.139	0.008	0.044
23	0.205	0.280	0.252	0.159	0.003	0.051
35	0.234	.....	0.205	0.173	0.016	0.064
56	.....	.....	0.159	0.178	0.006	0.110

TABLE 4.—*Autolysis at* p_H 5.3

	Total Nitrogen in per Cent					
Days of Autolysis	Albuminoid Nitrogen	Alpha-crystallin Nitrogen	Beta-crystallin Nitrogen	Albumin Nitrogen	Peptone Nitrogen	Nonprotein Nitrogen
0	0.212	0.324	0.346	0.034	0.001	0.016
3	.....	0.142	0.168	0.155	0.003	0.030
6	0.485	.....	.....	0.150	0.008	0.030
10	.....	.....	0.181	0.188	0.010	0.051
16	0.478	.....	.....	0.168	0.014	0.038
24	0.474	.....	.....	0.177	0.003	0.051
33	0.495	0.017	.....	0.178	0.003	0.051
54	0.554	0.011	0.141	0.176	0.003	0.051

In table 2, the same process is demonstrated with its corresponding long latent stage of primary autolysis. The first four tables show that the rate of primary autolysis is most rapid from p_H 5.5 to 6, and becomes slower at the p_H approaching 7.0. Near p_H 5.3, the amount of alpha-crystallin begins to decrease, and the albuminoid increases. As illustrated by tables 3 to 6, the rate of change of alpha-crystallin into an

albuminoid varies inversely with the p_H. Near p_H 4.8 or less, a part of the beta-crystallin becomes insoluble and behaves like albuminoid. However, p_H 6.0 or above is to be considered as the natural p_H of the whole lens undergoing autolysis, and at the present time, the p_H below 6.0 as

TABLE 5.—*Autolysis at* p_H 4.8

	Total Nitrogen in per Cent					
Days of Autolysis	Albuminoid Nitrogen	Alpha-crystallin Nitrogen	Beta-crystallin Nitrogen	Albumin Nitrogen	Peptone Nitrogen	Nonprotein Nitrogen
0	0.138	0.396	0.453	0.048	0.005	0.018
2	0.139	0.383	0.454	0.060	0.005	0.018
4	0.628	0.032	0.303	0.044	0.014	0.029
8	0.699	0.015	0.101	0.192	0.014	0.029
11	0.707	0.006	0.110	0.195	0.009	0.035
21	0.706	0.007	0.106	0.197	0.007	0.039
33	.....	0.011	0.110	0.197	0.006	0.040

TABLE 6.—*Autolysis at* p_H 4.2

	Total Nitrogen in per Cent					
Days of Autolysis	Albuminoid Nitrogen	Alpha-crystallin Nitrogen	Beta-crystallin Nitrogen	Gama Nitrogen	Peptone Nitrogen	Nonprotein Nitrogen
0	0.076	0.607	0.112	0.088	0.000	0.016
2	0.777	0.010	.....	0.028	0.001	0.015
5	0.791	0.001	.....	0.022	0.002	0.015
8	.....	.....	0.106	0.012	0.001	0.016
15	0.796	0.007	0.097	0.015	0.002	0.016
43	0.774	0.008	0.078	.....	.....	.....

TABLE 7.—*Autolysis Begun at* p_H 6.1 *and Changed to* p_H 7.4

	Total Nitrogen in per Cent						
Days of Autolysis	Albuminoid Nitrogen	Alpha-crystallin Nitrogen	Beta-crystallin Nitrogen	Albumin Nitrogen	Peptone Nitrogen	Nonprotein Nitrogen	p_H
0	0.122	0.314	0.490	0.045	0.005	0.014	6.1
2	0.122	0.323	0.466	0.065	0.005	0.016	6.1
4	0.123	0.320	0.441	0.105	0.005	0.016	6.1
5	0.120	0.316	0.438	0.131	0.005	0.016	7.4
8	.....	.....	0.283	0.179	0.018	0.018	7.4
12	.....	.....	0.276	0.176	0.014	0.024	7.4
24	0.121	0.328	0.280	0.174	0.003	0.041	7.4

an experimental effect. The results indicate that original albuminoid is resistant to the lenticular enzymes, although extremely slow acid hydrolysis is possible. In fact, after six months of autolysis at p_H 5, the albuminoid is practically unchanged.

If the autolysis is begun at a p_H 6.1 and the medium is then changed to p_H 7.4, the process continues, showing that the beta-protease has affected the protein sufficiently to allow the alpha-protease to act on it (table 7). The presence of active alpha-protease, which will act on

secondary protein derivatives, but not beta-crystallin and albumin in alkaline mediums, is shown by its action on gelatin and bacto-peptone at p_H 7.3 and 7.4 (tables 8 and 9). After the alpha-protease and beta-protease are inactivated by heat, no autolysis occurs (table 10).

The autolysis of the lenticular proteins is a subject of particular interest to ophthalmologists, since it has a definite bearing on the chrono-

TABLE 8.—*Autolysis of Lens Protein and Gelatin at* p_H 7.4

	Total Nitrogen in per Cent					
Days of Autolysis	Albuminoid Nitrogen	Alpha-crystallin Nitrogen	Beta-crystallin Nitrogen	Albumin Nitrogen	Peptone Nitrogen	Nonprotein Nitrogen
0	0.057	0.362	0.361	0.205	0.034	0.016
4	0.062	0.353	0.365	0.204	0.005	0.045
6	0.065	0.362	0.355	0.201	0.010	0.046
8	0.068	0.355	0.354	0.205	0.008	0.048

TABLE 9.—*Autolysis of Lens Protein and Bactopeptone at* p_H 7.3

	Total Nitrogen in per Cent					
Days of Autolysis	Albuminoid Nitrogen	Alpha-crystallin Nitrogen	Beta-crystallin Nitrogen	Albumin Nitrogen	Peptone Nitrogen	Nonprotein Nitrogen
0	0.073	0.301	0.375	0.138	0.023	0.101
3	0.077	0.306	0.363	0.124	0.011	0.130
7	0.075	0.303	0.371	0.102	0.020	0.140
9	0.079	0.304	0.361	0.094	0.028	0.147

TABLE 10.—*Autolysis of Boiled Solution*

	Total Nitrogen in per Cent			
Days of Autolysis	Total Nitrogen	Peptone Nitrogen	Nonprotein Nitrogen	p_H
0	0.864	0.003	0.012	6.8
9	0.866	0.003	0.012	...
24	0.860	0.002	0.012	...
39	0.868	0.006	0.014	6.8

logical pathologic changes of certain types of cataracts. A living normal lens must be injured by trauma, radiation, poisons and pressure, or its metabolism must be deranged by the changes in the constituents of the aqueous humor, or by changes in its capsule, before its normal metabolism is changed, acidity develops and autolysis results. The only natural way known in which a tissue protein disintegrates is by autolysis, caused by the proteases of the tissues.[6] The hydrolysis or heterolysis of the tissue which is caused by the leukocytes is secondary and frequently follows the primary autolysis or homolysis with its formation of

6. Bradley, H. C.: Autolysis and Atrophy, Physiol. Rev. **2**:415, 1922.

chemotactic substances. For the purpose of this discussion, heterolysis may be disregarded, although, under certain circumstances, it plays a part in the pathologic process of certain lenticular diseases.

From the experimental evidence which has been presented here, the autolytic process of the lens may be described as follows: In the lens there are at least two kinds of proteolytic enzymes. The first kind, the beta-protease, is active between p_H 7 and 4, and has an optimum activity at about p_H 5.0. It hydrolyzes the beta-crystallin and albumin in acid mediums into primary cleavage products, that is, protein derivatives of smaller molecular weight. The second kind of lenticular proteolytic enzyme, the alpha-protease, is active between p_H 8 and 3. It hydrolyzes the primary cleavage products into smaller secondary fragments such as amino-acids, peptides and peptones. The two types of lenticular proteases, however, are not to be confused with the pepsin and trypsin of the digestive tract. Under normal conditions, it may be said that the proteins of the lens are base-protein salts. Because the p_H of the normal lens is too high for autolytic activity, the beta-protease is inactive, although the proteins are available, and, therefore, practically no primary hydrolysis of the lenticular protein occurs. The alpha-protease is autolytically inactive in spite of the proper p_H for its activity, because there are no primary cleavage products available for it to hydrolyze.

If, however, any condition, such as an acidosis, arises which upsets this equilibrium, a change takes place. The lenticular acidosis may be the result of: (*a*) a generalized acidosis such as may occur in severe diabetes; (*b*) a localized ocular acidosis which may be caused by a disease of the internal structures of the eye, such as acute congestive glaucoma which lowers the p_H of the aqueous humor;[7] (*c*) or some condition affecting (decreasing) the permeability of a part or the whole of the capsule of the lens, (*d*) or sufficient destruction of the fibers of the lens or the epithelium. In any case, the hydrogen ion concentration of a part or of the whole of the lens is increased, or, in other words, the p_H is decreased. In a local lenticular acidosis of small degree, if the acid products which are formed by the dying and dead cells diffuse rapidly into the aqueous humor and are neutralized and carried away by the blood, little or no autolysis occurs. But if the acidosis is sufficiently great, so that the acid products are not removed rapidly, the autolysis begins. The acid products in acidosis are the fatty acids from the hydrolysis of the fats of the damaged tissues and especially the lactic, carbonic and phosphoric acids and acids of intermediary metabolism.

---

7. Kubik, J.: Experimentelle und klinische Untersuchungen über die Wasserstoffionenkonzentration des Kammerwassers, Arch. f. Augenh. **98**:483, 1928. Baurmann, M.: Ueber neue Messungen der H-Ionenkonzentration im menschlichen Kammerwasser, Arch. f. Ophth. **118**:369, 1927.

The result of the increased acidity is that beta-crystallin and albumin of the fiber or cell are autolyzed by the two proteolytic enzymes. The p_H is sufficiently low for the formation by the beta-protease of primary cleavage products, which in turn are hydrolyzed into amino-acids, peptides and peptones by the alpha-protease. The rate of autolysis and therefore the degeneration of beta-crystallin and albumin are dependent on many factors, such as:

(*a*) The amount of total acid associated with the protein molecule. The autolytic equilibrium is partly determined by the amount of acid-protein.

(*b*) The p_H of proteins. The p_H varies with the buffering power of the lenticular protein and the substances in solution, and also varies with dissociation of the acids.

(*c*) The amount of the proteolytic enzymes present. The amount of proteolytic enzymes is greater in the cortex than in the nucleus, and, partly for this reason, the cortex autolyzes more rapidly, if the other conditions remain the same.

(*d*) The kind and amount of protein. Chiefly beta-crystallin and albumin are the lenticular proteins which are autolyzed.

(*e*) The rate of diffusion of the acids and of the cleavage products from the site of acidosis.

(*f*) Time. If a slight acidosis exists for a short time, practically no effect may be observed, but if it exists for a long time, marked autolytic changes may take place.

(*g*) Vitality of the lenticular fibers and cells. In a slow chronic poisoning of the lens, which is produced by small doses of naphthalene, the more central and less vital fibers of the lens are affected. On the other hand, in a rapid acute poisoning of the lens, which is produced by large doses of naphthalene, the outer fibers and cells are affected because of the speed of the reaction.

(*h*) Density or hydration of the tissue. The cortex is more hydrated than the nucleus and is thus less resistant to proteolytic action.

The final result on the lens varies with the rate, intensity and location of the autolysis. If a few young lenticular fibers of the cortical layers are affected, the final result may be an atrophy of the corresponding lenticular fibers, which will be noticed with difficulty, because the outer cortical fibers contain a small amount of albuminoid.[8] Injury to the older fibers, which contain more albuminoid, will show a residual opacity in proportion to their age. If a large part of the lens is affected, one of the first results of the autolysis is the swelling of the lens through osmosis caused by the increased number of protein molecules from

8. Krause, A. C.: Unpublished data.

hydrolysis, which as yet are not diffusible through the capsule. After the diffusion of the secondary products, the layers and the fibers of the lens shrink through the loss of beta-crystallin and albumin, clefts containing the large molecular proteins, such as alpha-crystallin in solution are formed, and the masked lipoids are released from the fibers. The shrinkage is more noticeable in the outer layers, as they contain less albuminoid, which is the substance forming the framework of the visible residue. The lens or cataract in time shrinks. It, therefore, contains more albuminoid, alpha-crystallin and lipoids, and weighs less than the normal lens. If the capsule becomes sufficiently thick and impermeable, and the autolysis slowly continues, a morgagnian cataract results with a practically insoluble nucleus consisting chiefly of albuminoid. The tyrosine, leucine and cystine may precipitate out into the fluid in the sac, because they are the most insoluble of the amino-acids in solution, near neutrality.

CONCLUSIONS

1. An acidosis of the lens caused by dying or dead cells or fibers, which originates from internal or external causes, produces many of the pathologic changes of the lens.

2. The lens possesses at least two kinds of proteolytic enzymes. One kind, in acid mediums, hydrolyzes the beta-crystallin and albumin into the simple proteins. The second kind, in acid and alkaline mediums, hydrolyzes the simple proteins into amino-acids, peptides and peptones.

3. The beta-crystallin and the albumin are the chief lenticular proteins hydrolyzed by autolysis.

The material was obtained through the courtesy of Mr. R. E. Fox. The technical procedures were performed with the aid of Mr. F. W. Tauber.

EFFECT ON STEREOPSIS PRODUCED BY DISPARATE RETINAL IMAGES OF DIFFERENT LUMINOSITIES

F. H. VERHOEFF, M.D.
BOSTON

In a recent communication [1] I briefly described a new phenomenon in stereoscopic vision as follows:

If two nearly vertical black lines on a white background, at a slight angle to each other, are "fused" [2] by means of a stereoscope, they will ordinarily appear as a single intermediate line which has a fore and aft inclination. Let us assume that the upper end of the line before the right eye is tilted towards the right, and that of the other line towards the left. If now a smoked glass is placed before the right eye, the "fused" line will swing slightly towards the left, producing also a diminution in the stereoscopic effect. If the smoked glass is placed so as to obscure only half of the line, the "fused" line will appear bent in the middle. If instead of using a smoked glass, a graduated shadow is thrown on one line, the "fused" line will appear slightly curved. The displacement may also be observed in the case of lines nearly horizontal, placed at an angle to each other, where there is no stereoscopic effect. The phenomenon shows that when two disparate retinal images are made unequal in intensity, the position of the image resulting from their "fusion" is shifted towards the more intense image. It should not be confused with Pulfrich's phenomenon of the swinging pendulum. This is dependent upon the delayed perception of weak retinal stimuli, whereas in the present phenomenon, a similar time factor is not involved.

Since this publication I have made observations to ascertain whether or not the reduction in depth effect corresponds exactly to the lateral displacement described. The phenomenon occurs with any kind of disparate images, but it is practically impossible to make quantitative determinations in the case of images vertically parallel, owing to changes in disparateness resulting from constantly changing convergence. Since changes in convergence have no important influence on the effects produced by linear images which are angularly disparate, I have confined the present investigation to this type of images. The results obtained, however, are directly applicable to lateral disparateness of any kind.

From the Howe Laboratory of Ophthalmology, Harvard University, and the Massachusetts Eye and Ear Infirmary.

1. Verhoeff, F. H.: An Improved and a New Test for Stereoscopic Vision, Am. J. Ophth. **16**:589 (July) 1933.

2. The term "fusion," commonly used to express the union of images in the brain, seems to me a misnomer. It has occurred to me that the term "unification" is more descriptive of what actually takes place.

For the purpose of this study the ordinary Brewster stereoscope was deemed inadequate on account of the distortion produced and the difficulty of constructing accurate test objects on the small scale required. I therefore employed a much larger apparatus. This consists essentially of two circular rotary disks, placed side by side, each of which is 32 cm. in diameter and is viewed through two mirrors. The mirrors are so arranged that the image of each disk is perpendicular to and centered on the visual axis of the corresponding eye when the primary visual axes are parallel and directed straight ahead. Each disk is placed at a distance of 1 meter from the eye and is viewed through a spherical lens of 1 diopter. With both eyes, therefore, the effect is the same as if the unaided eyes viewed at infinity a large disk which subtended a visual angle of about 18 degrees. The two disks are connected by a wire passing around their circumferences so that by means of a convenient knob they can be rotated equally in opposite directions. The disks are equally illuminated by means of duplicate lanterns, each containing a 400 watt Mazda lamp and a large condensing lens. On each disk, detachable disks of white cardboard showing suitable diagrams can be precisely placed and centered. For the present purposes, identical detachable disks, one for each eye, were provided. Through the center of each disk was drawn a straight line 4 mm. wide and 30 cm. long and a concentric circle 8.8 cm. in diameter bounded by a line 0.5 mm. wide. In addition, two half disks were constructed which could be placed on the whole disks so that the test object for each eye would then consist of an upper and a lower radius which could be rotated independently. Dark screens were obtained by exposing photographic plates to light. These were placed at a distance of 25 cm. from the eye, in such positions as to obscure the upper or the lower half or the whole test object as desired. The apparatus was accurately adjusted by the aid of a spirit level and plumb lines. The intensity of the light reflected from the disks was measured by a Macbeth illuminometer.[3] At its maximum this was found to be 173.6 foot-candles directly from each disk, and 68.4 foot-candles after passage of the light through the mirrors and lens. The intensity of the light was reduced as desired by the use of two large rheostats.

When the detachable disks are placed in position, each with its line exactly vertical, the effect seen by an observer free from torsional deviation is that of a single vertical line lying in the plane of the circle. If the observer has torsional deviation, a corresponding rotation of the disks is necessary to place the line in the plane of the circle. When the disks are rotated outward, the line appears to slant upper end away from the observer (chart 1). When the disks are rotated inward, the

3. Mr. Eugene McCarthy of the Howe Laboratory made the light measurements and determined the absorption coefficients of the screens employed.

line slants in the opposite way, but it always appears as a straight line. If when the line is slanting upper end away from the observer a dark glass screen is placed before the right eye so as to obscure the lower half of the right disk, the lower half of the line appears to swing to the left and its fore-and-aft slant to diminish (chart 3). The question at issue is whether or not, if the disparateness of the retinal images of an actual slanting line is so changed as to produce the lateral displacement just noted, the change in depth effect will also correspond to that observed in the experiment.

This question was answered by the following experiments, which are explained by the accompanying diagrams (chart). The angles are exaggerated to make them easily recognizable—the diagrams are not constructed for use in a stereoscope. The disk before the right eye is designated by *R*; that before the left eye, by *L*, and the resulting stereoscopic picture, by *U*. The screened portions of the disks are indicated by shading. The screens employed had an absorption coefficient of 96.8 per cent, and the maximum illumination was used.

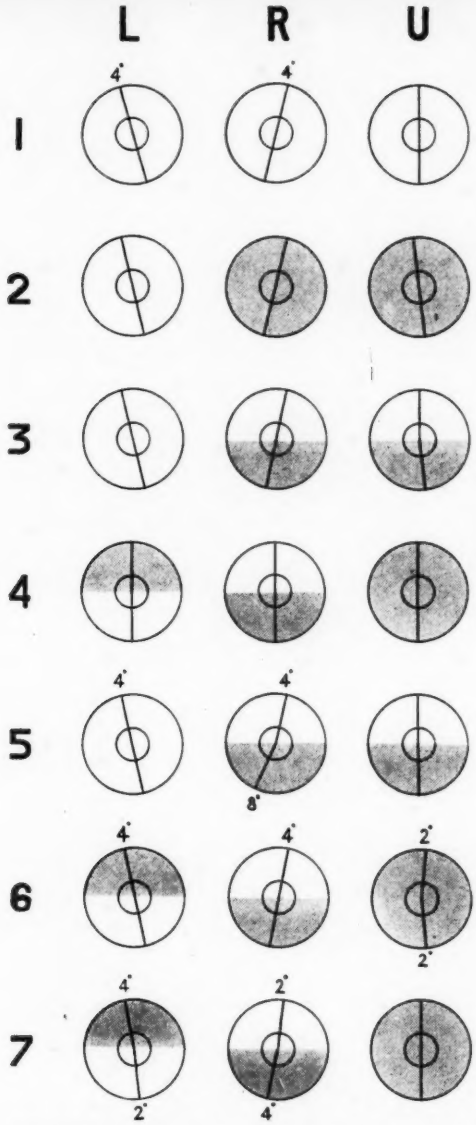
Experiment 2, in which an entire disk was screened, proved that since the line remained straight, the effect of the screen was in all respects the same in the upper and lower fields. It did not prove, however, that the lateral displacement corresponded to the depth effect, since it provided no means of measuring the latter.

In experiment 5 the lower half of the right disk was screened and the screened radius rotated independently until the whole line appeared straight in the midplane, with its upper end tilted away from the observer. During continued observations the effect fluctuated slightly so that the position of the screened radius needed to be changed to keep the line straight. It was noted, however, that when the lower radius was out of line, it was always so both laterally and fore-and-aft, and that when its lateral position with respect to the upper radius was correct, it always formed a straight line with the latter. This experiment proved conclusively that the effect of the screen on lateral displacement exactly corresponded to its effect on depth perception.

Experiment 7, considered in connection with experiment 2, proved the same thing in a different way. Here a screen was before each disk and the effects were divided between the eyes.

Experiment 4 proved that when there was no disparateness, changing the relative luminosities of retinal images produced no apparent displacement of the object.

In each of the experiments, other degrees of disparateness were used in addition to those indicated in the diagram, and it was found that the results were consistent with all degrees less than 12. Thus in experiment 2, with 6 degrees of initial disparateness an additional rotation of 3 degrees, with 4 degrees an additional rotation of 2 degrees,



R, indicates the diagram for the right eye; *L*, diagram for the left eye; *U*, the effect produced when *R* and *L* are united stereoscopically. The shaded areas indicate the screens. *1*, experiment 1: no screen. *U* shows a straight line in midplane with the upper end tilting away from the observer. *2*, experiment 2: Screen before *R*, absorbing 96.8 per cent of light which would have entered the right eye. *U* shows a straight line with the upper end displaced toward the left and tilting away from the observer. *3*, experiment 3: Screen shading the lower half of *R*. *U* shows the upper radius as in experiment 1, and the lower radius displaced with the lower end toward the right, and with less fore-and-aft tilt than is shown by the upper radius. *4*, experiment 4: Screens shading the lower half of *R* and the upper half of *L*. *U* shows a vertical straight line, unless the observer has a torsional deviation. If the observer has a torsional deviation the upper and lower radii will appear out of line, with different fore-and-aft tilts. By rotating *R* and *L* in opposite directions the radii may be made to assume a straight line and the number of degrees the disks have been rotated with reference to each other then measures the torsional deviation between the two eyes. *5*, experiment 5: Screen shading the lower half of *R*. The lower radius in *R* is rotated to overcome the effect of the screen. *U* shows a straight line in midplane tilted as in experiment 1. *6*, experiment 6: Screens shading the lower half of *R* and the upper half of *L*. *U* shows the upper radius tilting with the upper end away from the observer and displaced toward the right, and the lower radius tilting with the lower end toward the observer and displaced toward the left. *7*, experiment 7: Screens as in experiment 6. The upper radius in *L* and the lower radius in *R* are rotated to overcome the effects of the screens. *U* shows a straight line in midplane, tilting with the upper end away from the observer.

and with 2 degrees an additional rotation of 1 degree, was required to correct the effect of the screen. These results represented the average effects during the observations. The fluctuations that occurred were obvious, but not great. For example, with an initial disparateness of 4 degrees, a correction of 2.75 degrees for the effect of the screen was always too great and 1.75 degrees was always too little. In computing these results allowance was made for the torsional deviation of the eyes. Identical results were obtained with the screen before the left eye. These results show that the effect of the screen was directly proportional to the actual disparateness. This was shown also by the fact that the unified line never appeared curved.

With disparateness between the shaded and unshaded radii greater than 12 degrees, doubling and suppression of the images made it impossible to obtain accurate results. When the screen shaded either the upper or the lower part of a disk and the corresponding unified radius was made to tilt with its end away from the observer, doubling of the images, rivalry and loss of stereopsis occurred with much less disparateness (about 7 degrees), so that under these conditions significant results could not be secured.

The results that I have given were obtained by me, but they were in substantial agreement with those obtained by a number of other observers. I wore glasses with the following correction.

Right eye: —0.25 sph. = — 1 cyl. ax. 140 degrees
Left eye: +0.12 sph. = — 1.62 cyl. ax. 55 degrees

With these I had visual acuity in each eye of 20/12.5, left hypophoria ½ Δ, and for vertical lines extorsion of 1 degree.

The foregoing experiments show conclusively that if the luminosity of one retinal image, *A*, is reduced below that of the other, *B*, the effect on the apparent position of the object, as regards lateral displacement and depth, is the same as would result from a displacement of *A* toward *B* when their luminosities were equal, and the effect is directly proportional to the amount of actual disparateness. Under the conditions of the experiments, when the difference in illumination of the two images at the source is 96.8 per cent, the effect corresponds to a displacement of *A* toward *B* equal to one third of the actual disparateness.

I have made additional experiments, using screens with lower coefficients of absorption. With the maximum illumination and a screen with a coefficient of 80.4 per cent, the effect was to reduce the disparateness about one fifth. By reduction of the illumination, the effects of the screens were increased. With the 96.8 per cent screen, when the illumination of the unscreened disk was reduced below 3.27 foot-candles, movement of the screened radius often had no effect; that is, stereopsis due to the screened radius was often abolished. Through the lens and

mirrors this corresponded to an illumination of the unscreened disk of 1.29 foot-candles, and of the screened disk of 0.04 foot-candle. Under these conditions there was some degree of dark adaptation. With complete dark adaptation, no doubt the phenomenon could be obtained with much less illumination. I have also made experiments using disks 3.75 cm. in diameter with lines only 0.33 mm. in width. With these and with the maximum illumination, the 96.8 per cent screen abolished all stereoscopic effect, while the 80.4 per cent screen had the effect of reducing the disparateness about one third. With these fine lines, measureable effects could be detected with a screen having an absorption of about 15 per cent. I am now making further investigations in an attempt to correlate the changes in intensity, the coefficients of the screens and the width of the lines. Obviously the effects are due to changes in the relative intensities of the cerebral disparate images, and these are greatly affected by changes in the size of the pupils, the retinal adaptation and possibly other factors. Since in any theory of stereoscopic vision the phenomenon under consideration must now be given important consideration, it is hoped that these factors can be controlled sufficiently to yield results that can be quantitatively correlated. Thus far, however, I have not succeeded in obtaining such results.

CONCLUSIONS

When the luminosity of one disparate retinal image, *A*, is reduced below that of the other retinal image, *B*, the effect on the apparent position of the object as regards lateral displacement and depth is the same as would result from a displacement of *A* toward *B* when their luminosities were equal.

This effect is directly proportional to the amount of disparateness.

When there is no disparateness, there is no effect.

In the case of normal eyes, with black lines 4 mm. wide, angularly disparate, at a distance of 1 meter, and illumination of the white background equivalent to 68.4 foot-candles, a reduction of 96.8 per cent in the illumination of one image has the effect of reducing the disparateness about one third, and a reduction of 80.4 per cent has the effect of reducing the disparateness about one fifth.

The effect is increased by reducing the width of the lines.

Further investigation is required to correlate quantitatively the sizes of the retinal images, the difference in their intensities and the amount of illumination with the effects produced.

The effects described must be given consideration in any theory of stereoscopic vision.

FUNCTION OF THE REATTACHED RETINA

P. C. KRONFELD, M.D.
CHICAGO

First, I wish to apologize for the presumptuousness of the title of this paper. I am fully aware of the fact that the function of the reattached retina is almost as complex a problem as the function of the normal retina. It will therefore require considerable work on the part of physiologists, psychologists and ophthalmologists to define exactly how well a reattached retina functions after it has been detached for some time.

Until the problem of the function of the reattached retina is solved scientifically—which will take considerable time because of the relative scarcity of adequate material—there is need for a plausible, workable idea in regard to the probable functional outcome of an operation for retinal detachment before it can be recommended to the patient. It is true that in cases of partial but progressive detachment, even an anatomic cure or a reattachment without any return of function is a gain. The possibility of an improvement in function, however, will always be the main inducement to the patient.

The literature on the subject is meager. Before the tear-searing era, most of the reattached retinas which were seen were in cases of so-called detachment during pregnancy. Observations of such cases are quite numerous; the final outcome is nearly always good, but detailed functional studies have, so far as I know, never been made. Most authors confine themselves to statements concerning the central visual acuity and the visual fields, taken with one or two targets only. But even if there were accurate data concerning these cases of reattachment, they would not really be comparable to the reattachments which occur in idiopathic or traumatic detachments. The main difference between the two types is well expressed by the ophthalmoscopic picture which follows the subsidence of the detachment. The cases of detachment during pregnancy nearly always show partial atrophy of the optic nerves with narrowed arteries. Postmortem examinations of these eyes have revealed extensive choroidal arteriosclerosis which, however, may not have been present in every case of healed detachment during pregnancy. Extensive retinitic changes are common in those cases during the stage of toxemia or eclampsia.

From the Eye Clinic of The University of Chicago; E. V. L. Brown, M.D., Director.

Read before the Section on Ophthalmology at the Eighty-Fourth Annual Session of the American Medical Association, Milwaukee, June 14, 1933.

The idiopathic, cryptogenetic or traumatic detachment subsides—if it does so—under one of the following pictures: (1) no changes in the fundi outside of those at the site of the operative procedure or of the injury; (2) striae retinales; (3) diffuse proliferation ("shifting") of the retinal pigment.

From this comparison it can be seen that the clinical picture of the healed detachment in pregnancy is quite different from that of the idiopathic or traumatic and also more complex or less pure than the latter. Functional studies of one type of healed detachment would, therefore—if there were any—allow only remote conclusions in regard to the other type.

The tear-searing operation and the renewed interest in the surgical treatment of idiopathic detachment furnished for the first time in the history of ophthalmology a large number of cases of permanent reattachment. The idea of the tear-searing operation is now about ten years old. Its technic has been the subject of careful and extensive work, and today this operation has become one of the most valuable procedures at the command of the ophthalmologist. The number of cases in which a detachment subsides after closure of the tears and does not recur is undoubtedly steadily increasing. It may be of sufficient interest at this time to question the actual gain from postoperative reattachment.

In the literature of the last ten years one finds only casual and brief statements concerning this matter. All that is known at the time being was learned from Gonin [1] and is best expressed in the master's own words: "La réapplication anatomique de la rétine après plusiers mois de soulèvement n'implique par toujours le retour d'une fonction visuelle vraiment utile" (The anatomic reattachment of the retina after several months of detachment does not always mean the return of useful vision).

The data presented in this paper were obtained from patients under my care at the Eye Clinic of the University of Chicago, and from the literature, mainly from the papers of Lindner,[2] Vogt,[3] Weve [4] and Šafař.[5]

THE FUNCTION OF THE REATTACHED MACULA

The main difficulty in accurately answering the question of the function of the reattached macula is that from most of the reports found in the literature, the actual duration of the macular detachment cannot

1. Gonin, J.: Ann. d'ocul. **168**:689, 1931.
2. Lindner, K.: Arch. f. Ophth. **127**:177, 1931.
3. Vogt, A.: Klin. Monatsbl. f. Augenh. **82**:619, 1929; **84**:305, 1930.
4. Weve, H., in Abhandlungen aus der Augenheilkunde und ihren Grenzgebieten, Berlin, S. Karger, 1932, pt. 14.
5. Šafař, K., in: Abhandlungen aus der Augenheilkunde und ihren Grenzgebieten, Berlin, S. Karger, 1933, pt. 16.

be obtained. Perhaps this is due to some extent to the brevity of the reports, and to some extent probably to lack of subjective or objective observations, which make it impossible to determine the time of the actual onset of the macular detachment. In reviewing the literature I used as criteria for the complete detachment of the macula either a definite ophthalmoscopic picture or a visual acuity of 0.1 or less (corrected distance vision) or ability to read single letters of Jaeger's test type no. VI and less for an eye with approximately normal vision before the onset of the detachment.

A visual acuity of from 0.1 to 0.3 was considered as a sign of partial detachment of the macula if there was sufficient reason to assume normal vision before the onset of the detachment. Only cases in which the state of either complete or partial detachment of the macula had persisted for the entire alleged period were used for the basis of my conclusions. I am aware of the arbitrariness of the aforementioned classification and of the existence of borderline cases.

It is, however, possible to classify the reported cases of cured macular detachment according to the foregoing rules in the following groups:

1. Complete detachments with durations not over eight weeks. The literature contains numerous reports of unquestionable detachments of the macula which persisted up to eight weeks and then subsided following operative procedure with a final visual acuity of from 0.3 to 1.0 or a reading vision of Jaeger's test type no. I or II. In the majority of these cases the central vision seemed to be about as good as could be expected in the particular type of eye without considering the detachment. Up to a duration of eight weeks, a fair central visual acuity can, therefore, be expected.

2. Complete detachment of the macula for more than two months. Functional recovery becomes rare and should be considered as exceptional. It has, however, occurred, as the two cases of Vogt, one case of Šafar and perhaps others prove. One should, however, keep in mind that after three months have elapsed anatomic cures are less frequent also.

3. Partial detachments of the macula of less than two months' duration. The same considerations apply as in group 1.

4. Partial detachments of more than two months' duration. These seem to have a favorable prognosis in that improvements of central vision are rather common.

It is a question whether in any of these cases one could speak of "normal" function of the macula after the reattachment has taken place. I rather suspect, from Vogt's and from my personal experience, that a very slight degree of metamorphopsia or very fine, almost

undetectable, central or paracentral scotomas nearly always result from temporary complete detachment of the macula. The practical significance of these disturbances is, however, very slight, and the "unsteadiness" or "waviness" of the central vision of which many cured patients complain often has been only temporary. The visual acuity frequently does not reach its optimum until several weeks or months after the reattachment has taken place. Vogt observed a similar lag in the return of the ophthalmoscopic macular reflexes.

It is, however, astounding, as stated by Vogt, that after reattachment of the macula the central perception of form and space becomes so nearly perfect as it seems to do according to numerous reports.

THE COLOR SENSE OF THE REATTACHED MACULA

Most of the reports on reattached maculae do not mention the color sense, which probably means that no gross subjective disturbance was noticed by the patient.

One of Šafař's patients (his case 9), however, made some definite statements concerning his perception of colors. From Šafař's report it is easy to make the diagnosis of acquired tritanopia or yellow-blue blindness, a disturbance in the perception of color which is known to be present in almost every case of retinal detachment. The peculiar feature in Šafař's case is the fact that the tritanopia persisted after the retina became reattached. Whether this occurred in other cases but escaped the patient's and the physician's attention, I am not able to tell. All one can say at this time is that the pathognomonic tritanopia occasionally survives the retinal detachment.

In one of my cases of reattachment of the macula, I observed a peculiar disturbance of central color vision which appeared to be a partial tritanopia. I shall report the case at a later date.

THE PERIPHERAL RETINA

In the study of the function of the reattached peripheral retina, the main problem is the differentiation between damage done by the surgical procedure and damage done by the disease itself. In that respect the simplest case is that of a partial sector-shaped detachment with a single or several tears in the extreme periphery or a disinsertion. In my small series I have had six healed cases of this type, in four of which the patients were treated with the electric cautery, following Lindner's modification of Gonin's perforating thermocauterization. Two of the patients were operated on after Weve's method. The six cases have many features in common. The onset was gradual. The shape of the detachment was almost identical in each case. The detached portion of the retina, instead of following the concavity of the globe, formed the

convex surface of a cone the apex of which was located in the macula. Thus the height of the detachment increased gradually toward the equator. If a wide disinsertion was present, the most elevated point was the posterior edge of the disinsertion. If only small tears existed near the ora serrata, the most elevated point lay in the region of the equator. Old choroiditic lesions were usually found in both eyes, especially in the region of the retinal tears, so that the intimate relation between choroiditis and the formation of tears was quite obvious.

The duration of the detachment before the first operation was very uncertain in one case, probably less than three months in two cases and varied from five to fifteen months in the others. Five of the six patients were under 30 years of age; only one was over 30 (case 4). Two patients had suffered injuries shortly before the onset.

REPORT OF CASES

CASE 1.—Mrs. E. P., aged 26, was referred to me by Dr. Earle Fowler of Chicago, who had seen the patient first on Dec. 3, 1930. Four weeks prior to this date the patient discovered that she could see only part of an object when she looked with the right eye alone. There was no history of injury. General physical examination revealed no pathologic changes except two abscessed teeth, which were removed. I saw the patient first on December 29. Vision in the right eye (under atropine) was 0.3, with + 1.0 sph., 0.6; with + 3.0 added Snellen's test type 1.25 D was read fluently; vision in the left eye was 1.5—2.

Each eye showed a few old choroiditic lesions in the extreme periphery; the right eye had a detachment involving most of the lower temporal half up to the macula. A huge disinsertion of the retina extended from the radius 200 down to 250 degrees. Its greatest width measured 5 disk diameters. Old choroiditic lesions could be seen in the area of the disinsertion. Posteriorly and parallel to the latter, a stria retinalis could be made out. The detachment was transparent throughout outside of the posterior edge of the disinsertion; the retina was slightly wrinkled, formed grossly a plane surface and reached gradually a maximum prominence of 10 diopters at the edge of the disinsertion. Three ignipunctures were performed, on Dec. 30, 1930, Jan. 7 and Jan. 24, 1931, respectively. The vitreous remained perfectly clear, and ophthalmoscopic observation revealed clearly the fact which is now so well known, that the reattachment occurred promptly after the entire free edge of the disinsertion had become bound down to the choroid by the immediate effect of the ignipuncture or the consequent inflammatory reaction.

Ever since April 10, 1931, the visual acuity of the right eye has been 1.2—2, and no material change has been detected in the ophthalmoscopic picture and in the visual field. The region of operation has become a slightly prominent white area over which the retinal vessels run undisturbed. This white area extends considerably farther back than the previous disinsertion. With the von Graefe-Linder method of localization, it was found (before the first operation) that the most posterior portion of the posterior edge of the disinsertion was at an eccentricity of about 60 degrees. Now the very sharply defined edge of the white area lies at an eccentricity of from 40 to 50 degrees, varying in the various meridians.

The retina and choroid posteriorly to the white mass were found to be normal on ophthalmoscopic examination.

The right macula was tritanopic before the first operation (blue was seen as grayish green, a certain yellow as gray, an intense yellow as pink), but recovered completely. At the time of writing, no signs of any anomaly of the color sense (by anomaloscope, color mixer and Stillings plates) or any degree of metamorphopsia could be found.

The patient was last seen on March 15, 1933, and the eye was found unchanged (two years of postoperative observation).

CASE 2.—J. R., a youth, aged 18, was referred by Dr. George Suker of Chicago. I saw the patient first on March 16, 1931. Vision in the right eye was 1.5—2; that in the left eye was 0.6+2. The patient said that he had received two injuries to his left eye, the first in February, 1930, when a hard snowball hit the eye, resulting in temporary swelling and redness without any change in vision except for a few spots before the eye ("like a scum"). In October, 1930, vision

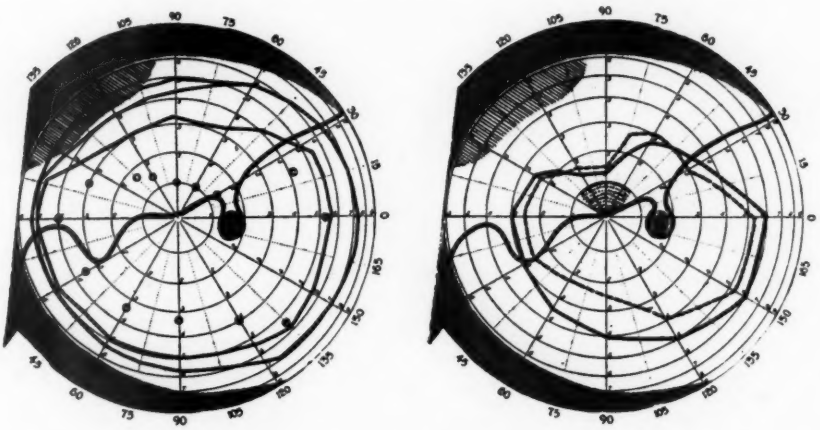


Fig. 1 (case 1).—The heavy, more or less diagonal lines indicate the extent of the detachment in terms of the largest field defect found.

in each eye was tested separately in the Student Health Department of The University of Chicago and found to be 20/20. The patient was not aware of any change in vision until the first days of February, 1931, after he had injured his left eye again by knocking off the bar in pole vaulting. Shortly after this he noticed a misshape of letters which later developed into blindness of the upper nasal portion of the field.

I found a rather flat detachment involving the lower temporal half of the retina, including the lower portion of the macula. The retina was translucent throughout. A disinsertion extended from the radius 275 up to 315 degrees. Four ignipunctures were performed to obliterate the disinsertion. The first ignipuncture was made in the radius 300 and came to lie about 2 disk diameters posteriorly to the posterior border of the disinsertion. The other three ignipunctures struck the free border of the dialyzed retina, and the disinsertion closed. On May 21, 1931, the retina was found to be completely reattached and has remained so, despite extremely strenuous physical exercises. The appearance of the scar changed somewhat; it expanded and became more pigmented. In the radius 305, the scar extended farthest posteriorly, apparently corresponding to the place of the first igni-

puncture. In the radius 295 a fairly round area of fine choroiditic changes could be seen somewhat separated from the bulk of the scar. This area probably accounted for the relative scotoma in the corresponding portion of the visual field (the stippled area in the visual field). I am not able to tell whether or not these fine changes were present before the first operation. The macula also showed fine old choroiditic lesions.

The central visual acuity of the left eye remained between 0.6 and 0.8. The patient could read the finest print without difficulty, and was aware of a slight metamorphopsia for distance. His central color sense was normal. He was seen again on March 15, 1933, and the eye was found unchanged (postoperative observation of twenty-two months).

Case 3.—E. F., a man, aged 27, was referred by Dr. William Benedict, of the Mayo Clinic. I saw the patient first on July 11, 1931. His right eye had been amblyopic since childhood. In 1926 a retinal detachment developed in his left eye following a blow to his head (in a prize fight; he was a professional boxer until

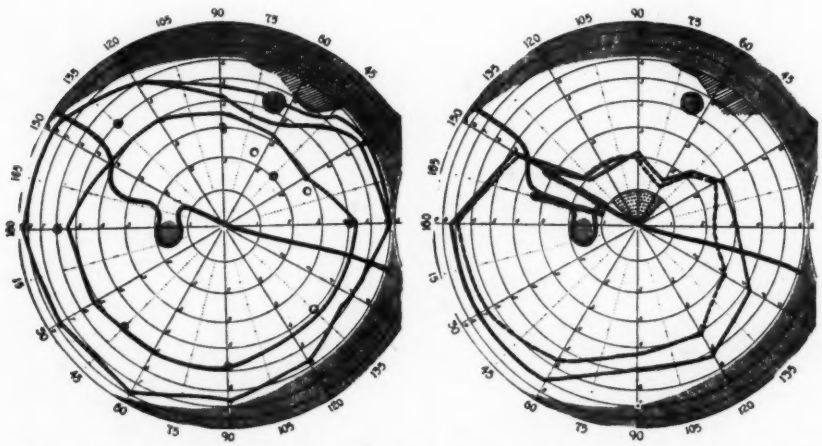


Fig. 2 (case 2).—The striped peripheral areas indicate the areas of operation as determined with the Graefe-Lindner method and projected into the visual field.

that time). Conservative treatment led to temporary reattachment, but return to normal life produced total detachment and finally a cataract developed. The patient gave up boxing and learned to get along with his amblyopic right eye which gave him very good service until a week prior to examination when, without any previous warning, he noticed distortion of vision. I found a balloon-like detachment of the entire lower half of the right retina with several tears in the extreme lower periphery. One of them was of considerable size (2 by 3 disk diameters), while the others were—at that time—very small and in the immediate neighborhood of the large one. A stria retinalis extended from the disk straight across toward the temporal side, just touching the macular area from below. Fine old choroiditic changes could be seen in the macular area. Vision in the right eye with + 4.50 sph. and + 1.0 cyl., axis 90 was 0.2—0.3.

Ignipuncture was performed on July 14, 1931, aiming at the large tear. Although only one fourth of its circumference was bound down immediately, the whole tear became closed within ten days, and the entire retina reattached. A month later, however, it was noted that temporally to the closed large tear a detachment had recurred, but remained limited to the extreme periphery from the 240 to the 265

radius, exactly corresponding to small tears that were not comprised in the ignipuncture. The condition remained unchanged until Nov. 13, 1932 (sixteen months), when new tears and corresponding areas of detachment were found in parts of the fundus which had been normal at the last examination. Diathermy treatment of the choroid over the areas of the tears led to their closure and to reattachment of the retina, which had persisted up to the time of writing.

I am here referring to the results as shown by the fields recorded before and after the first operation. Color fields were not taken in this case because of the amblyopia. The results would not have been comparable to those of the other cases.

Case 4.—J. O'M., a man, aged 55, was seen in the Eye Clinic of The University of Chicago first on Dec. 22, 1930. Vision in the right eye was 1.0—4; that in the left eye was limited to the perception of fingers at 3 feet eccentrically. The patient stated that his left eye had always been poorer than the right. Every time he had his eyes fitted with glasses, he noticed that the visual acuity in the left eye for distance was only about half as good as that

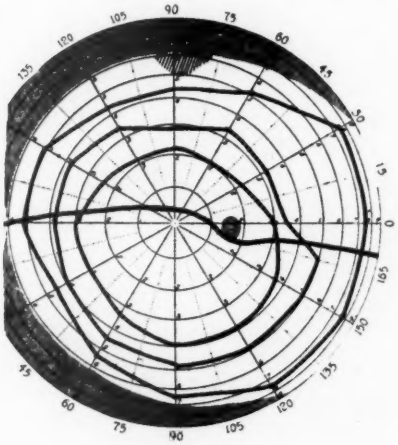


Figure 3

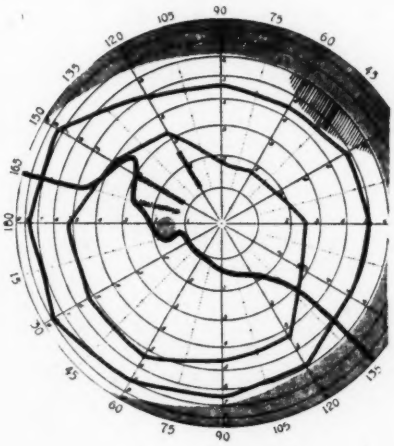


Figure 4

Fig. 3.—The nearly horizontal line indicates the original extent of the detachment in terms of the largest field defect found.

Fig. 4 (case 4).—The stippled areas indicate relative scotomas.

in the right eye. The patient was uncertain as to the exact date of the onset of his present trouble, but he was fairly certain that it was not over two months previously, when he noticed large floaters in front of the left eye. Then vision in that eye began to get worse.

I found that a little more than the lower temporal half of the retina, including the whole macula, was detached. A retinal disinsertion could be seen, extending from the radius 290 to 340 degrees. Old choroiditic lesions lay in the neighborhood of the disinsertion. Ignipuncture was performed in the area of the disinsertion on March 25, 1931, followed by improvement in the vision of the left eye to 0.2+1. A second ignipuncture was performed on April 9, and a third one on April 11. The course in the hospital after the third puncture was stormy. The patient vomited almost constantly the entire day following operation and was very restless. Ophthalmoscopic observation of the tear was difficult because only epinephrine, given subconjunctivally, produced sufficient dilation of the pupil.

On September 7, vision in the left eye was 0.2 to 0.3. The retina had become completely reattached. Some striae retinales had developed, mainly around the horizontal meridian on the temporal side.

CASE 5.—R. B., a man, aged 26, a lawyer, was first seen in the Eye Clinic of The University of Chicago on Dec. 19, 1932. In September, 1931,

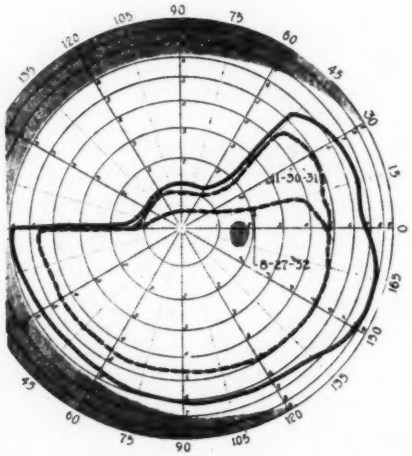


Fig. 5 (case 5).—The continuous circular lines are the isopters for 2, 0.5, and 0.17 degree white targets.

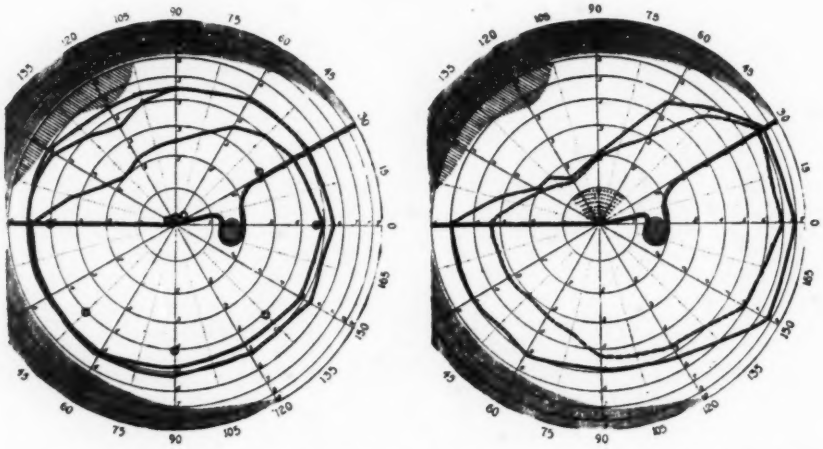


Fig. 6 (case 5).—The empty small circles give the outlines of the dark field.

he had first noticed that the vision in his right eye suddenly became blurred. On November 27, he consulted Dr. H. Christiansen of Chicago, who let me have his findings at that time (partial detachment of the right retina of unknown cause; vision in the right eye 0.1). About nine months later the patient was seen by Dr. Robert Buck of Chicago, who found the right field as shown in figure 5, a detachment of corresponding extent and a visual acuity of 10/200 (0.05). A surgical procedure was advised, but was not performed.

When I saw the patient the first time (Dec. 19, 1932), the detachment in the right eye was at least of fifteen months' duration. Ophthalmoscopically, it extended from the radius 180 to 325 degrees, including the macula. A retinal disinsertion occupied the area from 200 to 240 degrees and had a greatest width of 4 disk diameters. A few old choroiditic lesions could be seen in the neighborhood of the tear. On December 27, the right eye was operated on following the method of Weve, two rows of diathermic micropunctures being made posteriorly to the disinsertion. The postoperative course was uneventful. About four weeks after the operation, it could be stated with certainty that the retina was reattached everywhere. On March 20, 1933, vision in the right eye was 0.2, the periphery of the lower temporal retinal quadrant showed the picture of mild disseminated choroiditis, and the former edge of the disinsertion was not visible. The location of the most posterior edge of the choroiditic area was determined, and fields were taken. A fine old choroiditic lesion was detected in the macula. The perception of colors in the macula was within normal limits (postoperative observation of three months).

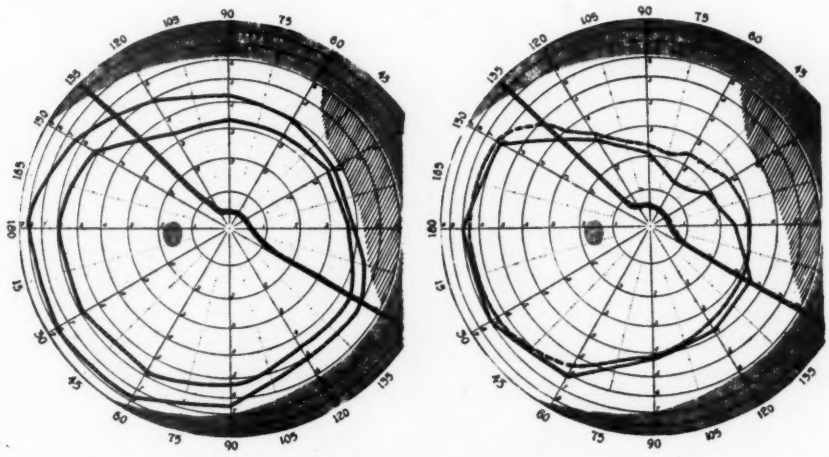


Fig. 7 (case 6).—A dotted line indicates the isopter for 2 degrees red; a more or less parallel continuous line, the isopter for 2 degrees blue.

Case 6.—B. M., a man, 22 years of age, a medical student at The University of Chicago, was first seen in the clinic on Dec. 24, 1932. Six months before, while inflating a tire, it blew out directly in the left half of his face. From that time on vision in the left eye decreased, images became distorted, and a defect in the upper nasal portion of the field became more and more noticeable. Vision in the right eye was (—5.00) 1.5—1; that in the left eye was (—4.00) 0.2. The left retina was detached from 210 to 45 degrees (radius), involving the macula partially. A stria retinalis went almost through the macula, parallel to the boundary of the detachment. Besides, a definite central choroiditis (traumatic?) could be seen. Multiple tears were found along the ora serrata on the temporal side; some of them lay in areas of old choroiditis or in small lesions of retinitis proliferans. The trauma to the retina had apparently been considerable. In order to wall off the whole area that showed defects from the healthy-looking though detached retina, the operation had to include retroequatorial portions of the retina. This was done with the diathermic needle on December 27. The postoperative course was uneventful. The retina was found reattached a few days after the operation and has remained so.

THE LIGHT SENSE OF THE REATTACHED PERIPHERAL RETINA

Because of lack of adequate apparatus, I had to confine myself to quantitative perimetry on the simplified Ferree and Rand perimeter and the Bjerrum screen, using white targets (Hering's white paper with a coefficient of reflection of 78 per cent) of from 2 to 0.06 degrees in diameter. The patients were subjected to these perimetric tests after a ten minute preexposure to the gray of the perimeter arc, which means moderate light adaptation. Visual fields were also taken in an absolutely dark room after twenty minutes of dark adaptation. The targets used in the latter test were projected on a gray screen by means of the Best mark-projector of Zeiss. The size of the target in these dark-field tests was 1 degree; the intensity of light could not be measured accurately because of the lack of a sensitive photometer. The projected light target was made intense enough to remain invisible to the fovea but to give an approximately normal peripheral field of from 50 to 70 degree radius, seen by a normal eye after ten minutes of dark adaptation. The dark fields could be taken in only three of the six patients.

Soon after I started the work on reattached retinas, I found that the targets of less than 10 arc minutes or 0.17 degree in diameter gave inconsistent results in reattached areas of the retina. A condition of intermittent visibility prevailed in most of the cases, irrespective of the eccentricity of the area examined. No definite and constant boundary of visibility could be obtained with the 0.06 or 0.12 degree targets, the difference in the coefficients of reflection between object and background being almost 75 per cent under an intensity of illumination of from 45 to 60 foot-candles.

This was the first quality of the reattached retina that suggested decreased sensitivity to light or increased absolute thresholds for light. Another fact which spoke in favor of this assumption was the increased sensitivity to variations of the coefficient of reflection of the background for targets over 0.17 degree in diameter. The behavior of the normal eye in this respect was clearly described by Ferree and Rand.[6] A reattached retina behaved differently, as an increase in the difference in coefficients of reflection between background and stimulus produced a widening of the field of from two to three times the relative amount exhibited by the normal eye.

From these observations it seems as though the differential threshold for intensities of light is considerably higher for a reattached than for a normal retina.

The most practical mode of quantitative perimetry on reattached retinas was to take the 2 degree white field on the gray perimeter arc and the 0.5 and 0.17 degree field on the black Bjerrum screen.

6. Ferree, C. E., and Rand, G.: Am. J. Ophth. **14**:1018 (Oct.) 1931.

In the visual fields shown, an attempt was made to put in the approximate extent of the obviously scarified or atrophied area as it was obtained by localization of its posterior edge with the Graefe-Lindner method. The scarified area showed quantitative differences in the degree and extent of choroidal atrophy and formation of connective tissue. In each case, however, it had distinct outlines so that the localization could easily be made. I realize that this method gives only approximate figures.

The six cases described in this paper showed isopters for a 2 degree white target, which checked surprisingly well with the edge of the scarified area. Larger white targets did not widen the field any more. The scar that follows the Gonin-Lindner or Weve method is, therefore, blind for formed white targets. The reattached retina posteriorly to the scar is enabled, irrespective of the duration of the detachment up to fifteen months, to recognize a white target of 2 degrees. That much peripheral vision can apparently be expected in every case of reattachment. The isopter for 0.5 degree white followed the one for 2 degree fairly closely.

The boundary of visibility for the 0.17 degree target behaved differently. It was definitely contracted in each of my cases, even in those in which the detachment had apparently been only of one or two months' duration. It was most marked in case 5, in which the detachment had persisted for at least fifteen months, and in case 4, that of the only aged person among my patients.

Another interesting feature is the longitudinal extent of the contraction for the 0.17 degree target. It is easily seen that the contraction extends far beyond the area of the operation; its longitudinal expansion seems to parallel the extent of the previous detachment. As to the latter, I have to admit that the boundary of the detachment was not determined accurately in any of my cases before the operation because of lack of adequate equipment. In my six cases, I am giving as the boundary of the detachment the edge of the largest defect in the visual field found with any target before the first operation. Thus if the detachment did not coincide with that of greatest field defect, it could only have been more, certainly not less, extensive than that given in my charts. Since March 1, 1933, I have been using the dark field as an index for the actual extent of the detachment, as was first advocated by Stargardt.[7]

The position of the 0.17 degree isopter after the reattachment seems to be determined largely by the duration and extent of the detachment and perhaps the age of the patient. From the behavior of the isopters for 2 and for 0.17 degree white targets, the function of the reattached

7. Stargardt, K.: Klin. Monatsbl. f. Augenh. **44**:353, 1906.

retina can be described as a real depression (Traquair) over the area of the previous detachment.

I shall now consider the dark fields. Stargardt thought that the light adaptation of a detached retina is nil and returns to normal after reattachment. The findings in my three cases did not confirm the latter part of Stargardt's thesis. The dark fields remained somewhat constricted in each case, the degree of constriction apparently varying with the duration of the detachment. In an extreme case, as in case 5, in which a detachment persisted over the same territory for at least fifteen months, the reattached retina did not regain its adaptability at all and remained, even after thirty minutes of dark adaptation, blind to the stimulus used. Thus it was possible to trace out the area of the previous detachment with great accuracy (see the earlier fields of this patient).

The other two patients showed only a moderate degree of constriction. Like the 0.17 degree isopter, the constriction paralleled quite closely the boundary of the former detachment.

Whether any of the diminution in light sense of the reattached retina is the result of the surgical procedure will be discussed in the following paragraphs.

THE PERCEPTION OF COLORS

In four of my six cases the color fields could be taken repeatedly after the reattachment had taken place. Two and 5 degree targets (Heidelberg papers) were used to determine the respective isopters; the gray arc of the simplified Ferree and Rand perimeter (corresponding to Hering's gray, no. 10) had to serve as a background for both colors, the intensity of illumination being from 4½ to 6½ foot-candles. Under these conditions, the normal eye usually gives a blue isopter just slightly wider than the red isopter. The reattached areas gave constricted isopters; the degree of constriction was either the same for blue and red or more marked for the former. This is easily understood if one remembers that the light sense of the reattached area is considerably diminished. The blue target, which is considerably darker than the red, is likely to be less distinguishable than the brighter red. No conclusions as to the relative degree of the blue and red perception in reattached areas are justified from the interlacing or criss-crossing of the isopters as found in my patients.

The areas which gave the constricted isopters were carefully searched for signs of tritanopia; the only thing found consisted of changes in saturation for all colors, but nothing characteristic of tritanopia. If the 2 degree targets showed a certain amount of contraction, it was impossible to widen those isopters by using 5 degree targets. The areas beyond those isopters were therefore totally color blind and thus differed

strikingly from the normal peripheral retina for which the width of the color fields can almost be brought up to that of the form field if a 5 degree target is used (Ferree and Rand [8]). At the present time, I am studying the luminosity curve for reattached, totally color-blind areas; the results of these studies will be published at a later date.

The paracentral reattached areas received special attention. In cases 1, 2 and 5, by moving the target around the fixation point in the parallel circles, sector-shaped areas (the stippled areas in the visual fields) were detected in which the color perception was considerably diminished. Again no sign of tritanopia was found or, in other words, blue was never seen as green, or vice versa, nor was any kind of blue-green equation accepted. All the color used (the pure red, green, yellow and blue of the Hering series) diminished in saturation over these areas. The border line between normal and disturbed perception was found to be rather sharp and consistent on concentric perimetry. After passing the borderline, the target lost its saturation more and more until it appeared absolutely colorless, or grayish white. That usually happened approximately in the bisector of the sector-shaped area of diminished color sense. When the target was moved still farther along the same parallel circle, the color gradually appeared again and increased in saturation up to the other borderline of the sector-shaped area. The target was moved with sufficient speed to avoid the influence of local adaptation. The phenomena described over the paracentral sector-shaped area depended to some extent on the size of the target, as the larger targets did not lose their color entirely. The borderline between undisturbed and disturbed color perception was found to be the same for targets up to 1 degree. All of these observations were made on the Lloyd stereocampimeter.

The visual field charts indicate that in my three cases (1, 2 and 5) it always was the upper quadrant or a little more than the upper quadrant which showed the diminution in color perception. Its location did not depend on the site of the operation. It was found equally marked in two cases of apparently short duration (from one to two months) and in one case of obviously long duration. The sector-shaped paracentral diminution in color sense seems, therefore, to represent the permanent sign of a sector-shaped partial detachment of the paramacular region which is within the aforementioned limits, independent of its duration.

If the longitudinal extent of the constriction of the isopters for colors is compared with the extent of the area of operation and with the extent of the detachment, it is easily seen that the longitudinal extent of the permanent constriction for colors parallels the extent of the previous detachment. The marginal portions of the detached retinal

8. Ferree, C. E., and Rand, G.: Psychol. Rev. **27**:1 (Jan.) 1920.

sector regain color perception over an extent of from 20 to 40 degrees, so that the permanently contracted area in the field is smaller than the previous detachment. The isopters in the constricted area are located between 15 and 25 degrees from the point of fixation. An obvious relation between the place of the surgical procedure and the constriction for colors does not seem to be present. All the phenomena so far described could be explained as results of the separation of the retina from its main matrix, and are more pronounced in the more elevated portions of the detached retina. The possibility that some of the loss in function can be blamed on the cauterization (direct or indirect, heat or toxic effects) cannot be denied. It is well known how much immediate damage a Gonin-Lindner operation does to the gross structure of the choroid and retina. According to Lindner,[2] an area about 0.75 mm. in radius beyond the ignipuncture is immediately destroyed. This does not allow any conclusions as to the permanent anatomic damage or to the functional loss. The latter depends on the location of the lesion in the retina and on many intangible factors.

The only reliable information can be obtained from the study of patients who had a successful Gonin-Lindner operation performed just a few days after the detachment had occurred, so that the retinal separation as a noxious agent on the function of the retina can be ignored. In my small series I have one patient whose detachment yielded to Gonin-Lindner operation within less than three weeks from the onset of the disease. His field for 0.5 degree white remained normal until his death, one and one-half years after the operation. No color fields were taken for this patient while he was under my care, because of his marked general weakness.

The literature contains several statements concerning patients of this kind in whom the color fields returned to normal. Gonin,[9] who apparently saw more recent detachments than any other surgeon, said: "Si la durée du décollement n'a pas outrepassé deux à trois semaines, c'est à peine s'il subsiste un certain degré de torpeur rétininienne dans l'éclairage abaissé, avec affaiblissement de la perception colorée" (if the duration of the detachment does not exceed two or three weeks, there barely remains a certain degree of retinal torpor in dim light, with lessened perception of color).

My personal conclusions are that with Gonin-Lindner, the Guist-Lindner and the Weve or Šafař diathermic method in cases of short duration, outside of occasional intraretinal hemorrhages, no visible or perimetrically detectable permanent damage is done to areas farther than 3 mm. away from the area of operation. Finer methods than

9. Gonin, J.: Ann. d'ocul. **167**:379 (May) 1930.

those applied in my cases might have revealed some remote effects of the therapeutic procedure.

It is also possible that the dent in the color fields in case 2 represents an injurious effect of the ignipuncture, superimposed on the effect of the retinal separation. The fact that no such notch was found corresponding to the other ignipunctures (in cases 1 and 2) speaks against the aforementioned assumption. It therefore seems as though the gross functional defects described in this paper are the result of the detachment and not of the operative intervention.

SUMMARY

1. Most of the reports on reattachments of the macular region lack precise statements regarding the duration of the detachment. Knowledge concerning the functional prognosis of detachment of the macula is, therefore, still meager. In partial or complete macular detachments of less than two months' duration and also in partial macular detachment of more than two months' duration, the prognosis concerning restoration of function is favorable.

2. The function of the reattached retina was studied in six cases of partial sector-shaped retinal detachment of more than one month's duration, which yielded to Gonin-Lindner or Weve diathermic operations. The 2 degree white isopter was normal outside of its limitation at the area of operation. The 0.17 degree white isopter was found constricted in each case, the degree of radial constriction apparently strictly depending on the duration of the detachment and perhaps on the age of the patient. The dark field paralleled the isopter for 0.17 degree closely, outside of the fact that in one case of very long standing, the dark field (taken with the usual target) remained nil over the entire reattached area. The longitudinal extent of the constriction for white, colored and light targets in the dark room paralleled the extent of the detachment. No definite signs of remote, permanent, noxious effect from uncomplicated operations after Gonin-Lindner, Lindner-Guist and Weve-Safar were found.

ABSTRACT OF DISCUSSION

DR. WILLIAM L. BENEDICT, Rochester, Minn.: There are two reasons for studying the function of the retina that has been detached and has later become reattached. One is that it enables one to judge the operation that will restore the detached retina, and the other that it gives a much better means of estimating the length of time elapsed since the separation. Dr. Kronfeld's methods of study are more meticulous than those most of us have been employing. The use of the dark field enables one to determine at the same time with much greater accuracy the limits of the detachment and the light threshold, which, as we know, decreases gradually according to the length of time the detachment has persisted. It also aids in the detection of shallow detachments.

Detachment of the retina in pregnancy, which, we know, heals spontaneously, falls in a different class from the detachment due to injury of the choroid, and the return of function in the two forms is quite interesting. In going over our cases of spontaneous reattachment in retinitis of pregnancy, we found that the retinas assumed their function almost before the reattachment was complete, that is, while we could still notice considerable edema. The fields, however, did not increase after six months. We have followed one patient for six years. In detachment due to injury, to tears in the retina or to possible disinsertion from trauma, one sees first a rather translucent appearance of the retina which probably parallels the function of the retina. Several months after detachment the retina becomes almost translucent. I should like to have Dr. Kronfeld give his opinion as to the probability of restoration of function as judged by the translucency of the detached retina.

In a case of detachment of the retina in which there is choroiditis, the retina may have been detached for a long time, longer than we assume from the history of the patient. If we date back the detachment of the retina to the time the patient noticed loss of vision or scotoma, we may not have come to the time of the original detachment, but to the time when it began to interfere with the patient's central vision and make noticeable the scotoma on one side. If there is a degree of rapidity of restoration of function, is there likewise a degree of rapidity of loss of function; and is the loss of function due to the edema of the retina, to trauma of the nerve ends in the retina or to some other process? In examining the periphery of the fundus for evidence of detachment, one is aided by the use of shadows of the vessels, as brought out by Lindner.

Dr. Clifford B. Walker, Los Angeles: I shall show the quantitative measurements obtained in one case, because of critical observations contributed by Dr. John M. Wheeler and Dr. Steele, who happened to be visiting our perimetric room while the postoperative field was being recorded.

The first slide shows the condition present before operation in a man aged 71. The difficulty in obtaining the field of vision in the eye with a six months' nontraumatic separation of the retina with no central vision was overcome by the use of the other eye. In the first chart one finds at the separated margin that color interlacing is truly represented. It is further to be seen that although the central vision is very low, the best portions of the field still detect movements of the 2/1,000 disk, and measurements, though not accurate, apparently showed that one portion of the detached retina had some visual ability for a short distance, about 10 degrees of field, or perhaps 2 mm. of retina. I have likewise seen these conditions in a patient in whom central vision was almost normal and poor fixation could be ruled out as a cause. The field taken before operation was obtained on March 21, 1932; the next opportunity to take the field was almost a month after the operation, on April 22. To my surprise, the patient could actually see a 1/2,000 disk extending out to the 12 degree circle, and he could also see a 1/1,000 disk extending out as far as 20 degrees. The blind spot was not greatly enlarged. The color fields were shrunken about 10 degrees, but were free from the color interlacing. Most satisfactory to the patient, however, was the increase of central vision to 20/30 and the ability to read the newspaper. I report the fields because I have not so far seen any actual quantitative field studies in the literature made before and after operation.

Dr. Vernon A. Chapman, Milwaukee: One point that puzzled me for a good many years is the fact that the retina so thoroughly and completely loses its function almost immediately on being detached. This occurs even in the

absence of edema and of traumatism to the nerve endings, the retina appearing perfectly normal, except for its position, with its blood vessels not damaged. It seems to me that there is something about visual perception which is not due to the retina alone; that possibly there is a physiochemical relation between the retina and the choroid which is destroyed immediately the retina is detached, but which is reestablished in part when the retina is reattached.

DR. PETER C. KRONFELD, Chicago: I expect I did not make myself clear when I spoke of dark fields. We take them by placing the patient in a dark room for thirty minutes, and take the fields by projecting small white targets on a gray screen using a dim red light for fixation. Unfortunately, I did not have a photometer to measure the exact amount of light.

I am not prepared to answer all the questions that arose, especially the last question of Dr. Benedict as to the relation between the degree and extent of the translucency of the retina and the return of function. I should have to go over all my records to answer that question.

I do not agree with Dr. Chapman. Many times I have been surprised because a retina that is detached functions so well.

I think that most of the time we are thoroughly mistaken when we think of the retina as becoming detached over night.

In my paper I have mentioned a patient who was referred to me by Dr. Benedict, a man, aged 27, who had lost the vision of one eye from retinal detachment years before, and whose other eye was amblyopic. In this eye he had detachment of the entire lower portion and a slightly opaque retina. He said that the detachment had developed within four days. Nevertheless, the ophthalmoscopic picture showed clearly a well developed stria retinalis extending from the disk to the temporal side, which we know takes weeks or months to develop. Thus, this man had lost complete vision in one eye from retinal detachment; every day he woke up dreading that something might happen to the other eye. Nevertheless, he overlooked the early stages of detachment in his only seeing eye. That is the discrepancy I have seen.

If you are interested in the subject of function of the reattached retina, I should like you to read a paper by Sallmann, from Lindner's clinic in Vienna.[10] I am glad to say that his conclusions come very close to mine save for one point. Sallmann states that the visual fields keep on improving for from one to two years after operation, which is something my small series does not bring out. The process of recovery, so far as I could determine, was finished within three or four months after operation.

---

10. Sallmann, L.: Arch. f. Ophth. **130**:1 (May) 1933.

ACTINOMYCOSIS OF THE ORBIT

M. N. BEIGELMAN, M.D.
LOS ANGELES

Actinomycosis of the orbit is not known to occur as a primary disease; the fungous infection, as a rule, invades the orbital cavity by extension from the surrounding tissues. Because of the preexisting involvement of the head, these patients are rarely under the care of ophthalmologists—a fact which accounts for the small number of reports in the ophthalmic literature. To Cavara,[1] the author of the volume on "Ocular Mycosis" in the "Trattato di micopatologia umana," belongs the credit for extricating from the general medical literature all instances of actinomycosis in which orbital complications were observed. Among the seventeen cases collected by Cavara, some are presented in a way which can hardly satisfy an ophthalmologist, since an inadequate orbital symptomatology is given, without reference to the visual functions or to the ophthalmoscopic findings.

In this country no case of orbital actinomycosis in a human being has been reported. However, the mention of "exophthalmos" in several publications of American authors makes it possible that among the one thousand cases of actinomycosis reported so far in the United States, the orbit may have been involved in some instances.

The purpose of this communication is to present the history and the histobacteriologic findings in a case of orbital actinomycosis in which autopsy material was available for study, and in connection with this case to review the clinical and pathologic aspects of this rare complication.

REPORT OF A CASE

Robert W. C., aged 45, a plasterer, was examined at the outpatient clinic of the Los Angeles General Hospital on Aug. 2, 1929. In the region of the parotid gland on the right side he had a rather hard tumor, about 6 by 4 cm.; the mass had been present for three weeks and was painless. On Aug. 13, 1929, the growth was excised and referred for a pathologic examination. The laboratory report stated that the tumor was a granuloma of undetermined etiology.

The wound did not heal smoothly; for a long time there was considerable discharge; the secretion was repeatedly examined, with negative results. On October 20 the first ocular symptoms, in the form of exophthalmos of the right eye and edema of the eyelids, were noticed, and it was assumed that the disease process

---

From the Department of Ophthalmology (service of Dr. George W. McCoy) and the Pathologic Laboratory of the Los Angeles General Hospital.

1. Cavara, V.: Le micosi oculari, Siena, Tip. S. Bernardino, 1928.

extended into the right orbital cavity. The visual acuity at that time was 20/20 in each eye. A roentgenologic study of the teeth on October 28 revealed marked caries of the second upper bicuspid on the right side with a rarefied area at the apex. Throughout the year 1930 the orbital condition became slowly but definitely worse. The exophthalmos increased, "lumps" appeared in both the upper and lower eyelids, and changes in the fundus in the form of a vascular stasis and later of a mild optic neuritis were noticed. On Sept. 4, 1930, the visual acuity of the right eye was 20/50. Antisyphilitic treatment administered for several months during 1930 did not result in any improvement of the orbital lesion. Fistulous

Fig. 1.—Section of granulomatous tissue in the orbit (hematoxylin-eosin). Above, ray fungus surrounded by an inflammatory infiltration; below, sclerosed connective tissue with remains of an extra-ocular muscle.

passages and sinuses appeared in the soft tissue around the right orbit, and these were repeatedly incised and curetted. The steadily increasing exophthalmos necessitated tarsorraphy, which was carried out on Nov. 20, 1931. Shortly afterward, neurologic examination revealed some mild meningeal symptoms—rigidity of the neck and a bilateral Kernig sign. Gradually a low grade meningitis developed, later supplemented by evidences of involvement of the right temporal lobe. On Jan. 21, 1932, the patient died.

Autopsy, performed by Dr. W. G. Harding, II, on Jan. 22, 1932, revealed considerable thickening of the bone at the roof of the right orbit. After the orbit was opened a large amount of fibrous tissue was found posterior to the eyeball and immediately surrounding the optic nerve; it seemed to replace the normal fat.

The extensive changes present in the brain were grossly diagnosed in the neuropathologic laboratory in the following manner: multilocular abscess of the apex of the right temporal lobe; a small granuloma of the right side of the pons; localized basilar meningitis. A smear from the abscess of the brain showed a fungus-like organism. On Sabouraud's medium it grew along the line of inoculation on the surface; after from seven to ten days it formed a white, chalky membrane. The best growth was observed after three weeks. The same cultural characteristics were found on a potato medium. On dextrose broth, the growth was chalky at the margin of the tube, and small, woolly colonies were seen at

Fig. 2.—Section of the optic nerve showing thickening and inflammatory infiltration of the sheaths.

the bottom of the tube. The mycelia were very fine, with a tendency to curly, sometimes cork-screw, branching; club-shaped ends were not observed in the culture material. The spores were round and arranged in chains, resembling Streptococcus, and they did not show acid-fast properties when first grown. The growth was both aerobic and anaerobic, the aerobic growth being the better. A guinea-pig was inoculated with material from one of the original cultures, and autopsy after eight weeks gave negative results. The report of the mycology laboratory was: family Nocardiaceae, genus Nocardia.

The contents of the right orbit were examined histologically. The optic nerve itself was little involved, and the changes were almost entirely limited to its sheaths. The dura and the arachnoid membrane were thickened, at times to a

marked degree (fig. 1). The pia was densely infiltrated with small lymphoid cells, and in some sections these cells seemed to extend into the optic nerve proper along the interstitial septums. However, this extension of the inflammatory infiltration could be seen only at the very periphery of the optic nerve. The large amount of granulomatous tissue which was present in the orbit consisted mostly of sclerosed connective tissue. The predominating type of cell was the small lymphocyte. Not infrequently one could see the characteristic chromatin spokes of the plasma cells, and occasionally polymorphonuclear leukocytes and large endothelial cells were encountered. The granulomatous tissue was closely associated with bundles of muscle fibers still recognizable in the sclerosed mass of the granuloma. The normal orbital fat was preserved only in a small number of widely separated areas. In a few sections the ray fungus was found (fig. 2); no bacteria was revealed in sections stained by the Weigert-Gram method.

COMMENT

The clinical features of this case can be summarized in the following way: The first manifestation of the actinomycotic infection took place in the right preauricular area in the form of a large, tumor-like granuloma. About four months afterward the first symptoms of orbital involvement—exophthalmos of the right eye with swelling of the eyelids—were noticed. For two years the orbital condition resisted all therapeutic efforts; it then became complicated by meningitis and an abscess of the brain, as a result of which the patient died.

In the present case, as well as in all hitherto reported ones, the orbital involvement was secondary to an actinomycotic infection of the head. The first, and for many months the only, clinical evidences of the disease were limited to the area of the right parotid gland, in analogy with the observation of Rocher and Jeandelize[2] on primary actinomycosis of the parotid extending into the orbit. The word "primary" used on this occasion by the French authors is not to be taken literally. It was brought out in the discussion of their report that the preauricular disturbance had come into existence in one of the following ways: through Steno's canal, through the oral mucosa or through the external integuments. These possibilities existed, of course, in the present case also. I was unable to find the exact place of the original entry of the fungus. A review of the literature reveals that the place of entry was not established in a definite manner by any of the investigators. This is not surprising if one considers the tendency of the actinomycotic process to heal in one area while it spreads in another direction; by the time orbital complications arise, the site of the primary lesion may be lost, or represented by one of the numerous scars. Most of the authors who wrote on the subject of orbital actinomycosis (Pon-

2. Rocher, L., and Jeandelize, P.: Un cas d'actinomycose parotidienne primitive propagée à l'orbite, Rev. méd. de l'est **48**:283, 1920.

fick,[3] Ransom,[4] de Quervain and Bourquin,[5] Müller,[6] Borel[7]) were inclined to assume that the fungus originally lodged in a carious tooth. The nearest positive proof of this was given by Ransom, who found on autopsy a direct communication, along the outer orbital wall, between the infectious sinus in the orbit and the mucous membrane of the upper jaw close to the first molar. Other writers were satisfied merely with the finding of carious teeth in patients with orbital actinomycosis. Ginsberg[8] and Nasse[9] believed that the point of entrance in their cases might have been in the mucosa proper of the oral cavity: near the maxilla (Ginsberg) and in the pharynx or in the tonsil (Nasse). Evidences in favor of the opinion advanced by these authors were circum-

TABLE 1.—*Cases of Orbital Actinomycosis*

Author	Year	Sex	Age	Occupation	Probable Place of Entry
Ponfick[3]	1881	M	45	Barber	Carious teeth
Nasse[9]	1889	M	19	Farmer	Pharynx or tonsils
Ginsberg[8]	1890	M	30	Merchant	Oral mucosa
Ransom[4]	1896	F	32	.....	Carious teeth
deQuervain and Bourquin[5]	1897	M	61	.....	Carious teeth
Vossius[16]	1902	M	28	Shepherd	Carious teeth
Coppez and Depage[17]	1903	M	56	.....	Carious teeth
Koch[10]	1904	M	Boy	.....	
Müller (Zahn)[6]	1910	F	33	Farmer	
von Stubenrauch: München. med. Wchnschr. **59**: 1193, 1912	1912	M	68	.....	
Borel[7]	1912	F	26	Farmer	Carious teeth
deLapersonne, quoted by Cavara[1]	1919	M	..	Teamster	
Rocher and Jeandelize[2]	1920	M	..	Soldier	Oral cavity
Pascheff[11]	1921	M	62	.....	Injury in supraciliary region (?)
Guarino[14]	1905	M	28	.....	Antrum (?)
Axenfeld[13]	1902	F	20	.....	Ethmoid sinus (?)
Pagani[15]	1926	M	14	.....	Carious teeth
Beigelman	1933	M	37	Plasterer	Carious teeth

stantial and not convincing: Nasse discounted the dental origin of the infection in his case because the barber who had extracted an upper molar at the beginning of the disease decided that the tooth was normal.

3. Ponfick, E.: Die Aktinomykose des Menschen, eine neue Infectionskrankheit auf vergleichendspathologischer und experimenteller Grundlage geschildert, Berlin, A. Hirschwald, 1882.

4. Ransom, W. B.: A Case of Actinomycosis of the Orbit, with a Summary of Seven Other Cases of Actinomycosis, Brit. M. J. **1**:1553, 1896.

5. de Quervain, F., and Bourquin, E.: Sur les complications cérébrales de l'actinomycose, Rev. méd. de la Suisse Rom. **17**:145, 1897.

6. Müller, P.: Ueber die Aktinomykose der Orbita, Beitr. z. klin. Chir. **68**:135, 1910.

7. Borel: Un cas d'actinomycose de la face et de l'œil droit, Rev. méd. de la Suisse Rom. **32**:314, 1912.

8. Ginsberg, S.: Kasuistische Beiträge zur Kenntnis der Aktinomykose des Menschen, Berlin, Druck G. Chaste, 1890.

9. Nasse: Berl. klin. Wchnschr. **26**:120, 1889; quoted by Cavara.[1]

I could find no confirmation of Cavara's statement that on two occasions (in the cases of Koch [10] and Pascheff [11]) the fungus penetrated through an external wound of the face. As a matter of fact, no reference to an injury was made by Koch in his brief report on a case of orbital actinomycosis, presented under the heading of "Orbital Phlegmon." The misunderstanding is possibly due to the mentioning in the same article of a "lacerated wound" in another case of orbital phlegmon of nonmycotic origin. In Pascheff's case, recently reported before the German Ophthalmologic Society, the injury was in the form

TABLE 2.—*Cases of Orbital Actinomycosis Observed Until Fatal Termination*

Author	Duration of Disease from First Orbital Symptoms to Death	Cause of Death	Autopsy Observations Indicating Route of Cranial Involvement
Ponfick [3]	14 months	Actinomycosis of brain	Partial destruction of basilar and sphenoid bones; orbit not examined
Nasse [9]	5 months	Purulent meningitis	Jugular foramen invaded
Ginsberg [8]	6 months	Actinomycosis of brain; abscess of left temporal lobe	Granuloma in the area of the sella turcica extending from the orbit through the optic canal
Ransom [4]	5 months	Purulent meningitis; small multiple abscesses of brain	Extension of the actinomycotic process along the outer wall of the right cavernous sinus to the base of the brain
de Quervain and Bourquin [5]	7 months	Abscess of brain	Sphenoid fissure invaded
Vossius [16]	8 years	Actinomycosis of brain	Petrous bone affected
Coppez and Depage [17]	1 year	Typhoid	No autopsy
Koch [10]	Several months	Meningitis	Foramen magnum invaded
Müller [6]	Several months	Meningitis (?)	No autopsy
Pagani [15]	2½ months	Cerebral lesion	Cranial cavity not investigated
Beigelman	27 months	Abscess of brain	Basilar meningitis and abscess of the right temporal lobe

of a simple contusion and took place twenty-five years prior to the onset of the orbital symptoms.

From the oral cavity, which is probably the common seat of the primary actinomycotic lesion, the disease process may extend in time into the orbit along the outer surface of the superior maxilla (cases of Ransom [4] and of de Quervain and Bourquin [5]). This route, however, must be considered as an exception. More often the infection spreads through the oral mucosa and the adjoining soft tissues of the face to the infratemporal fossa; from there it penetrates through the sphenoid

10. Koch, C.: Orbital phlegmone durch Aktinomykose, Ophth. Klin. **8**:279, 1904.

11. Pascheff, C.: Ueber eine Streptothrix-Strahlenpilzgeschwülst der Orbita, Klin. Monatsbl. f. Augenh. **47**:302, 1921.

fissure into the retrobulbar space. Müller [6] analyzed seven cases of orbital actinomycosis in which the route of the mycotic extension could be followed up; he found that in five of them the orbital invasion took place through the sphenoid fissure. It is interesting to note that in spite of the long duration of the actinomycotic infection in the temporal and infratemporal fossae its transgression into the orbit directly through the bony external wall has never been reported. This is in accordance with the fact, known from the general literature on actinomycosis, that the ray fungus seldom attacks osseous tissues in man (A. Sanford and M. Voelker [12]).

On three occasions the orbital involvement was secondary to an actinomycotic process in the adjacent nasal sinuses. Axenfeld [13] was the first to present a case in which actinomycosis of the ethmoid cells was followed by an orbital infection. Shortly afterward Guarino,[14] and in recent years, Pagani,[15] reported an extension of the mycotic infection from the antrum into the orbit of the same side.

Müller's [6] assertion that actinomycosis of the face never extends into the orbit through the anterior orbital aperture seems to hold true as far as the available literary material is concerned. This is probably due to the fact that actinomycosis of the face is more accessible and can be localized more effectively than actinomycosis of the oral cavity or of the nasal sinuses.

Whatever the route of the orbital invasion is—through the sphenoid fissure, from the adjoining nasal sinuses or along the surface of the maxilla—its clinical manifestations are always the same. The granulomatous process back of the eyeball results in slowly increasing exophthalmos, as a rule without pain or any other acute inflammatory symptoms. In fact, whenever the latter present themselves, a secondary pyogenic infection is likely to account for them. Corresponding to the position of the granulomatous process in the orbit a lateral displacement of the eyeball is often seen in association with the exophthalmos. In due time, the inflammatory infiltration may spread forward into the eyelids; nodules of various sizes then appear under the skin, and some of them eventually break through, giving rise to fistulous passages and sinuses.

---

12. Sanford, A. H., and Voelker, M.: Actinomycosis in the United States, Arch. Surg. **11**:809 (Dec.) 1925.

13. Axenfeld, T.: Ein Beitrag zur Pathologie und Therapie der frontalen und der ethmoidalen Sinusitis und ihrer orbitalen Complicationen, Deutsche med. Wchnschr. **28**:713, 1902.

14. Guarino: Esoftalmia consecutiva a una localizzazione di actinomyces bovis nell'antro de Highmoro; operazione e guarigione, Ann. di ottal. e clin. ocul. **35**: 318, 1906.

15. Pagani, M.: Nocardiasi dell'orbita, Lettura oftal. **3**:337, 1926.

The mobility of the eyeball becomes affected early. In most instances the limitation of movement is due to a purely mechanical cause—the presence of a large retrobulbar mass. However, at times the extrinsic muscles or the motor nerves supplying them are found to be affected. In the reported case the extra-ocular muscles were heavily infiltrated and partly replaced by fibrous tissue. Vossius [16] described atrophic changes in the oculomotor, abducens and trochlear nerves, and Cavara [1] assumed that the ptosis of the upper eyelid in Axenfeld's [13] case was of similar origin.

The optic nerve becomes involved in two ways: 1. Through pressure caused by a massive infiltration of the surrounding orbital tissues, primary atrophic changes may take place in the fibers of the optic nerve. 2. The inflammatory process may extend through the sheaths and the interstitial septums into the optic nerve proper, resulting in a true optic neuritis. Ophthalmoscopically the early evidences of involvement of the optic nerve are in the form of a vascular stasis with or without changes in the disk; later the appearance is that of atrophy of the optic nerve. The deterioration of the visual functions may vary from slight changes of the visual field to complete blindness. In advanced stages of the disease, corneal complications due to lagophthalmos or of neurotrophic origin (Coppez and Depage,[17] Borel,[7] Pascheff [11]) may also be responsible for a loss of sight. In several cases there was a striking disproportion between the severity of the orbital involvement and the resulting decrease of vision; in spite of the extreme exophthalmos and the immobility of the eyeball the visual functions remained surprisingly good over a considerable period of time. This was true, for instance, in the case reported here: Prior to the onset of meningeal symptoms the visual acuity remained satisfactory, although the proptosis became so pronounced that tarsorrhaphy had to be resorted to. The explanation of this peculiarity lies in the strongly expressed tendency of the actinomycotic process to become a localizing fibromatosis. The areas of fungous activity are thus often walled off from the rest of the orbit, and the optic nerve remains little affected throughout the course of the disease. This point is brought out in the autopsy report of Ransom's case: "The greater part of the cavity of the orbit was found to be healthy and separated from the sinus along its outer wall by a layer of firm fibrous tissue."

The unusual preservation of visual functions is an interesting feature of orbital actinomycosis, and on some occasions it may be of value in differential diagnosis. The appearance of nodules or fistulous passages

16. Vossius: Zwei seltene Fälle von Orbitalaffektion, Ber. ü. d. Versamml. d. ophth. Gesellsch., Heidelberg **30**:210, 1902.

17. Coppez, H., and Depage, A.: Un cas d'actinomycose orbitaire, J. de méd. de Bruxelles **8**:753, 1903.

in the eyelids, in the presence of orbital symptoms, is also suggestive of a mycotic lesion. But the two deciding points in establishing the correct diagnosis are: (1) evidences of an actinomycotic process in the head, particularly in the temporal and infratemporal areas and (2) the finding of the organism in the discharge from the sinuses or fistulous passages around the orbit. The diagnostic value of biopsy in these cases is limited to the possible identification of the fungus in sections of tissue. The histologic picture as such offers nothing pathognomonic. The early infiltration consists chiefly of polymorphonuclears, with some epithelioid cells and occasional giant cells. In later stages proliferative changes take place, often with a tendency to the formation of massive connective tissue. On the other hand, "purulent" foci come to existence through a more or less extensive necrotization. Depending on the predominance of either proliferative or degenerative phenomena, the hyperplastic or the suppurative types of actinomycotic lesions are often referred to. It is an accepted view that granulomas of identical structure are seen in many other mycotic and nonmycotic infections.

Once the nature of the orbital involvement is determined, the ophthalmologist is confronted with the problem of managing a rare and dangerous condition, for which no standardized and effective treatment is known.

Large doses of potassium iodide, from 1 to 10 Gm. a day, are probably the only noncontroversial remedy for actinomycosis of the orbit. Although in vitro this preparation is unable to inhibit the growth of the fungus, its effect on the altered tissue is doubtless beneficial. In several cases of orbital actinomycosis a definite though temporary improvement after its use has been observed. The experience with roentgen therapy and with autogenous vaccines is insufficient for any conclusions. In the surgical care of the orbital complication, most authors have limited the intervention to minor procedures, such as incisions of the abscesses, scraping of the sinuses and fistulas and orbitotomies for drainage. Müller [6] was the only one to advocate complete removal of the diseased foci from the orbit. In order to obtain a satisfactory exposure of the orbital contents he recommended Brun's temporary resection of the malar bone, which he considered superior to Krönlein's method. This radical operation was performed by Müller in his own case, with an immediate improvement of the orbital symptoms. However, very shortly the exophthalmos again increased, and two months after the operation the patient died of an extension of the actinomycotic process into the brain. One cannot help thinking that in the attempt to remove all abnormal tissue, damage may be done to the fibrous membranes through which a localization of the diseased process is effected. Thus perhaps new avenues are opened for the spreading and generalization of the actinomycotic disease.

Whatever the choice of therapeutic and surgical methods is, one cannot feel encouraged by the experience accumulated so far. Of eighteen cases reported in the literature, eleven are known to have terminated in death; in one a recovery was registered, and in six the final outcome remained unknown. In considering these unfavorable statistical data, the following points must be stressed: The danger of the orbital actinomycosis lies, of course, in the possible extension of the disease into the cranial cavity along the optic canal and the sphenoid fissure. It has been brought out by F. P. Moersch [18] that actinomycosis of the central nervous system has a "markedly insidious onset, meningeal involvement occurring without any clinical signs or symptoms. . . . In no other form of severe meningitis do we see such a lack of clinical findings. The ability of these patients to be up and about, presenting few complaints, such as moderate headache, slight rigidity of the neck, and only slight temperature, is practically unknown among other forms of meningitis." It is probable, in other words, that while one proceeds with radical or conservative treatment of the orbital lesion, the patient is already doomed because of an existing meningeal involvement, even though there are no clinical manifestations of it. On the other hand it is known from several autopsy reports that the actinomycotic process may reach the brain not only from the orbit but also through the openings and bones at the base of the skull (jugular foramen [Nasse [9]]; foramen magnum [Koch [10]]; petrous bone [Vossius [16]]; basilar and sphenoid bones [Ponfick [3]]). These parts of the head are inacessible for treatment; the ophthalmologist, even if he succeeds in controlling the orbital involvement, is unable to foresee or to prevent meningeal complications extending from the base of the skull.

18. Moersch, F. P.: Actinomycosis of the Central Nervous System, Arch. Neurol. & Psychiat. **7**:745 (June) 1922.

USE OF NUPERCAINE IN OPHTHALMOLOGY

E. E. DILLON, M.D.
AND
C. GREER, M.D.
CHICAGO

Nupercaine is one of a number of new local anesthetics recently put on the market and recommended as of value in ophthalmology. Chemically it is the hydrochloride of alpha-butyl-oxycinchoninic acid diethylethylene-diamide and thus belongs to the quinoline group and is related to quinine. It is non-narcotic and bears no relation to cocaine. It occurs in colorless crystals, easily soluble in water and alcohol; solutions are very stable and withstand repeated sterilization without loss of potency. Alkaline-free glass containers should be used to prevent precipitation, or a few drops of very dilute hydrochloric acid may be added to the solution. Vasodilatation occurs when it is used topically or is infiltrated, and a few drops of epinephrine may be added to counteract that effect.

The toxicity of nupercaine should be kept in mind when it is used for infiltration. According to Uhlmann's [1] determination, the lethal dose by subcutaneous injection is 10 mg. per kilogram of body weight for nupercaine, 50 mg. for cocaine and 400 mg. for procaine hydrochloride. However, nupercaine is not more toxic than cocaine when it is considered that it is used in much greater dilutions to obtain equal anesthesia. Christ states that one may safely inject 400 cc. in a dilution of 1:2,000, 150 cc. in a dilution of 1:1,000 or 50 cc. in a dilution ot 1:500. Thus the maximum dosage has been set at 0.2 Gm. for adults.

Experimental work on nupercaine in ophthalmology has been reported by L. von Liebermann [2] and by Wiesli.[3] The latter tested it over a period of two years and found a 1:1,000 dilution of nupercaine equal to 3 per cent cocaine. There was no injury to the cornea or delay in healing of the operative wounds, and the duration of anesthesia was greater than with cocaine.

From the Department of Ophthalmology, Northwestern University Medical School.

1. Uhlmann: From the laboratories of the Ciba Co.

2. von Liebermann, L.: Zur Indikation der orbitalen Anästhesie nebst Bemerkungen über ein neues Anästhetikum, Klin. Monatsbl. f. Augenh. **84**:74 (Jan.) 1930.

3. Wiesli, P.: Perkain als Oberflächenanästhetikum in der Augenheilkunde, Ztschr. f. Augenh. **76**:157 (Jan.) 1932.

Nupercaine was first tested in the department of ophthalmology in rabbits' eyes. After the use of 1 drop of a 1:1,000 solution, the corneal reflex was abolished in fifty seconds on an average in three rabbits. It remained abolished for an average of twelve hours. With 1 drop of 1:500 solution the reflex was absent in thirty seconds and remained so for an average of twenty hours in three rabbits tested. There was no pupillary dilatation or congestion, and the corneas appeared normal.

In three patients after the use of 1 drop of 1:1,000 dilution of nupercaine, the corneal reflex was abolished in four minutes, and returned in fifty-eight minutes on an average. With 1 drop of 1:500 dilution in three cases, the reflex was gone in ninety-eight seconds and returned in one hour and forty-three minutes on an average. In no

Results with Nupercaine in Two Cases

Time After Instillation, Min.	Mrs. L. N.						Mr. E. S.					
	Nupercaine 1:500 2 Drops Size of Hairs			Cocaine 2% 2 Drops Size of Hairs			Nupercaine 1:500 2 Drops Size of Hairs			Cocaine 2% 2 Drops Size of Hairs		
	No. 1	No. 4	No. 10	No. 1	No. 4	No. 10	No. 1	No. 4	No. 10	No. 1	No. 4	No. 10
5	—	—	—	—	—	—	—	—	—	—	—	—
10	—	—	—	—	—	—	—	—	—	—	—	—
15	—	—	—	—	—	—	—	—	—	—	—	—
20	—	—	—	—	+	+	—	—	—	—	—	—
25	—	—	—	+	+	+	—	—	—	—	+	+
30	—	—	—	+	+	+	—	—	—	—	+	+
35	—	—	+	+	+	+	—	—	—	+	+	+
40	—	+	+	+	+	+	—	—	+	+	+	+
45	—	+	+	+	+	+	—	—	+	+	+	+
50	—	+	+	+	+	+	—	+	+	+	+	+
55	—	+	+	+	+	+	+	+	+	+	+	+
60	+	+	+	+	+	+	+	+	+	+	+	+

case was there any pupillary dilatation, corneal change or reaction other than slight vasodilation of the conjunctival vessels.

The effects of a 1:500 dilution of nupercaine and 2 per cent cocaine on corneal sensitivity have recently been compared; Frey's hairs were used. Nos. 1, 4 and 10 of the set designed for testing the sense of touch were used. Two drops of each anesthestic were instilled in separate eyes at two minute intervals and the sensitivity tested at five minute intervals until the corneas were again sensitive to the hairs. The solutions were dropped directly on the cornea and the lids manipulated to distribute them evenly, the patient being kept in a horizontal position. Two drops were used because often hardly enough of the first drop is retained, owing to spasm of the lids and lacrimation, to produce anesthesia even to no. 1 Frey hairs. The touching of an unanesthetized cornea with a no. 1 hair produces a painful prick and a corneal reflex, and it is easy for both the patient and the examiner to determine when anesthesia is absent (table).

The results in two persons with normal eyes are tabulated; the plus signs indicate sensitivity, and the minus signs, lack of sensitivity. From these records it is seen that the duration of anesthesia from a 1:500 dilution of nupercaine was approximately twice that from 2 per cent cocaine. No epinephrine was used in either solution, the vasodilatation produced by nupercaine and the vasoconstriction produced by cocaine being quite evident.

The anesthesia produced by 2 drops of a 1:500 dilution of nupercaine is sufficient for the removal of ordinary foreign bodies on the cornea, for tonometry and for cauterization of corneal ulcers.

After using a 1:250 dilution of nupercaine and instilling fluorescein, we were unable to detect any staining of the cornea under the slit lamp. Formerly we had observed staining of the rabbit cornea after using a 1:500 solution and had expressed the opinion that a solution stronger than 1:500 should not be used for instillation. In view of our later experience, it would seem that a dilution of 1:500 will not damage the cornea.

Fowlkes [4] has recently reported a case of severe localized and mild generalized dermatitis due to the local application of a nupercaine ointment about the anal region. Similar reactions sometimes follow the use of procaine hydrochloride and butyn. However, we have seen none following the use of nupercaine. Mannheimer [5] reported a case in which the patient was sensitive to procaine hydrochloride and to "pantocaine" (*p*-butyl aminobenzoyl *di*-methyl-aminoethanol hydrochloride).

Numerous reports on other local anesthetics have recently appeared. These drugs are not distinguished by longer anesthesia than that produced by cocaine. A number of authors, including Wilmer,[6] have claimed advantages for "pantocaine" over cocaine for all purposes, the advantages being lesser toxicity and greater economy, since the drug can be used in high dilutions.

It is not the purpose of the present article to compare the effect of nupercaine with that of cocaine for all purposes, since the anesthetics now in use may be said to be quite satisfactory. We have not used nupercaine for intra-ocular operations, although it is recommended for that purpose by Potvin in the literature supplied by the manufacturers. He recommends the use of dilutions of from 1:1,000 to 1:500 for injection and 1:200 for instillation. However, in certain types of

4. Fowlkes, R. W.: Dermatitis due to Nupercaine, J. A. M. A. **100**:1171 (April 15) 1933.

5. Mannheimer, M.: Pantokainüberempfindlichkeit, Deutsche med. Wchnschr. **59**:95 (Jan. 20) 1933.

6. Wilmer, W. H., and Paton, R. T.: Pantocain as a Local Anesthetic in Ophthalmology, Am. J. Ophth. **16**:106 (Feb.) 1933.

operations in which considerable corneal epithelium is removed, such as in operation for pterygium, there is considerable after-pain, and it is in such cases that an anesthetic with more prolonged effect might have distinct advantages. Therefore, in a series of ten cases of pterygium nupercaine was used by instillation and injection. None of the patients complained of severe after-pain, and in a number there was no postoperative discomfort whatever. With nupercaine a somewhat longer time is necessary for the induction of anesthesia, from fifteen to twenty minutes being necessary in cases of pterygium. In some cases sufficient anesthesia could be obtained by instillation alone, while in others the injection of from 2 to 3 drops of a 1 : 1,000 dilution were necessary. On the whole, the freedom from after-pain was quite definite as compared with that in patients operated on under cocaine anesthesia.

A 1 : 500 ointment of nupercaine furnished by the manufacturers was used, and particular freedom from after-pain was noted in cases of corneal abrasions, pterygium and other conditions.

Particularly because of its prolonged anesthetic effect, nupercaine is a valuable drug in certain ophthalmologic procedures.

News and Notes

EDITED BY DR. JOHN HERBERT WAITE

UNIVERSITY NOTES

Dr. Clifford B. Walker of Los Angeles has been appointed clinical professor of ophthalmology at the College of Medical Evangelists.

Dr. Walter I. Lillie, associate in ophthalmology at the Mayo Clinic since 1921, has been appointed professor of ophthalmology at Temple University School of Medicine.

The University of Buffalo Gold Medal is awarded annually to the author of an article on an ophthalmologic or allied subject. Details of the award may be obtained from the Dean of the Medical Department.

SOCIETY NOTES

North and South Dakota Academies of Ophthalmology and Oto-Laryngology.—On an invitation from the Mayo Clinic, the Academies met at Rochester, Minn., on Sept. 29, 1933. The day was occupied with operative clinics and addresses by members of the Mayo Clinic staff, and the evening by a dinner at the Kahler Hotel.

Eye Section, Philadelphia County Medical Society.—The newly organized Eye Section held its first meeting Tuesday, October 10. Dr. George E. de Schweinitz gave an illustrated talk about "The Ocular Manifestations of Arteriosclerosis, Nephritis, Diabetes and Increased Intracranial Pressure." The new organization has a membership of approximately one hundred ophthalmologists, and its first meeting was well attended.

GENERAL NEWS

Treacher Collins Memorial Fund.—To perpetuate the memory of Edward Treacher Collins, the Royal London Ophthalmic Hospital plans to rebuild its pathologic department, to be renamed the "Treacher Collins Pathological Institute." The money subscribed is to be used for endowment and not for building. Subscriptions may be sent to Theodore W. Luling, Esq., at the Hospital.

Abstracts from Current Literature

EDITED BY DR. WILLIAM ZENTMAYER

Aqueous Humor

ACUTE ACCUMULATION OF CHOLESTEROL IN THE ANTERIOR CHAMBER: REPORT OF A CASE. K. REHSTEINER, Klin. Monatsbl. f. Augenh. **89:** 291 (Sept.) 1932.

The right eye of a girl, aged 15 years, had been blind since an accident twelve years prior to observation by the author, who was consulted soon after the eye became painful and something "white" had formed in it. The inflamed eye showed a few maculae and beginning ribbon-shaped degeneration of the cornea. The lower portion of the anterior chamber was filled with needle-shaped, highly opalescent cholesterol crystals, some of which were suspended in the aqueous humor. Iridodialysis, total cataract, posterior synechiae and increased tension were present. Perception of light was uncertain and projection lacking. The anterior chamber was filled almost completely during the following seventeen days, and the eye had to be removed because of persistent pain. Histologic examination revealed total detachment of the retina, druses in the glassy lamella, particles of bone in the suprachoroid, calcifications on the ora serrata, a limited amount of cholesterol and blood in the vitreous chamber and droplets of fat in the cornea, sclera and ciliary body. The cholesterol crystals in the anterior chamber were free from any admixture of blood or exudative material. They may have been derived from hemorrhages in the detached retina, whence they migrated into the anterior chamber, or else direct elimination of cholesterol occurred from the blood stream into the vitreous and anterior chamber as a consequence of pathologic changes in the barrier between blood and aqueous humor. The author referred to Schaaf's research on fats from the blood in xanthomas of the skin, because also in his case the cholesterol in the blood was diminished, while the lecithin was increased.

K. L. STOLL.

Color Sense

STATISTICS ON COLOR BLINDNESS AMONG STUDENTS IN PEIPING. S. P. CHANG, Nat. M. J. China **18:** 958 (Oct.) 1932.

This paper deals with the study of color blindness exclusively of congenital origin. Ishihara's book entitled "Test for Color Blindness" was consulted in making the tests. Among 2,396 students, 99, that is, 4.3 per cent, were color blind. Among 1,164 males, 6.9 per cent were color blind, and among 1,132 females, 1.7 per cent. The form of color blindness was as follows: red-green, 76 persons, and color weakness, 23. The ages of the patients examined varied from 8 to 20.

S. H. MCKEE.

Conjunctiva

SPRING CATARRH IN EGYPT. A. F. EL-TOBGY, Folia ophth. orient. **2:** 168, 1933.

This article is based on the literature and on the author's considerable experience with spring catarrh. He reviews the theories as to etiology (autointoxication, infection, photochemical reaction, disturbance of body hormones and metabolism) and comments on them. He feels that the cause has not yet been discovered. Biochemical investigations were fruitless in his cases. Differential blood counts showed no increase in eosinophils; the Wassermann reactions were negative, and the amount of calcium in the blood serum varied so widely that the importance of its rôle could not be evaluated. The known forms of treatment were employed. These included tarsectomy, autohemotherapy, injections of splenic extract, the administration of arsenic and calcium, the application of lactic acid and chaulmoogra oil and exposure to ultraviolet rays and radium. Radiation produced the only good results. Of twenty-five patients irradiated, fourteen were improved and three were cured.

G. M. BRUCE.

TWO CASES OF RARE PIGMENTATION OF THE EYEBALLS. B. KAYSER, Klin. Monatsbl. f. Augenh. **89:** 777 (Dec.) 1932.

A case of pigmentation of the eyeballs is reported in a healthy, active and well nourished woman, aged 71, whose eyes and vision were normal. During the past five years a small brown spot in the conjunctiva near the caruncle of the left eye was observed to extend gradually toward the limbus, to vary in size and intensity and finally to become very dark and thickened. Similar changes were observed on pigmented areas of the lower lid, the plica, the lower fornix and a few spots on the conjunctiva of the lids. The etiology of the pigmentation at the caruncle, which ultimately looked like a pigmented nevus, could not be explained. No organic diseases, like Addison's, avitaminosis or scurvy, were present; it was not congenital, and no pigment-forming drugs such as epinephrine were used.

The diagnosis of melanosis of the conjunctiva was made.

The second patient, a healthy fair complexioned man, aged 50, with light color of the iris and dark hair, had bilateral, ring-shaped pigmentation overlying the episcleral vessels and adjacent to a broad gerontoxon. The formation resembled the descriptions given by Meesmann and Ascher of the findings in patients suffering with Addison's disease. The absence of any diseases or of the use of drugs made it impossible to establish the etiology of this unusual pigmentation in a white man.

K. L. STOLL.

Congenital Anomalies

LENS WITHOUT A NUCLEUS OR APPLANATION OF THE CORNEA? F. SALZER, Klin. Monatsbl. f. Augenh. **88:** 372 (March) 1932.

Under the term "a human lens without a nucleus, a hitherto unknown malformation," the author reported the case of a neurasthenic woman, aged 45. In her right eye he thought he had found an absence of the nucleus of the lens (*Klin. Monatsbl. f. Augenh.* **84:** 52 [Jan.] 1930; abstr., ARCH. OPHTH. **4:** 241 [Aug.] 1930).

Recent examination of the same eye revealed applanation of the cornea as the cause of the abnormal condition and refraction. The nucleus of the lens was present, and the lens normal, although it showed the central interspace between the cortical and the nucleus to be broader and darker than common. A technical explanation for the erroneous diagnosis is rendered.

K. L. STOLL.

AN ANOMALY OF THE EYELASHES. K. HIROSE and M. HIRAYAMA, Acta Jap. Ophth. Soc. **36:** 108 (Aug.) 1932.

A girl, aged 17, exhibited on the tarsal conjunctiva of the upper lid, 2 mm. posterior to the margin of the lid and a little to one side of the middle of the lid, a black hair, which was directed upward. The eyelids were otherwise normal. The hair, together with the surrounding tissue, was examined histologically; the hair was found to be an eyelash and represented an aberrant hair anlage.

A. KNAPP.

Cornea and Sclera

THE ORIGIN OF ANTERIOR LENTICONUS. A. FEIGENBAUM, Folia ophth. orient. **1:** 103 (Nov.) 1932.

Basing his conclusions on a survey of the literature and on his own observations, the author believes as follows:

1. Anterior lenticonus is acquired in postembryonic life as a result of weakness in the anterior capsule of the lens.

2. The weakness depends on disturbances which occur during the separation of the vesicle of the lens from the surface ectoderm.

3. The degree of the anomaly may increase and may lead to the bursting of the capsule and the formation of a stationary anterior capsular cataract. Vision may thus be improved, and so extraction should not be advised too quickly in cases of anterior lenticonus.

G. M. BRUCE.

BLOOD STAINING OF THE CORNEA. E. A. POTECHINA, Sovet. vestnik oftal. **2:** 83, 1933.

According to the author, there were only four cases of blood staining of the cornea reported in the Russian literature previous to the five described in the article. The etiologic factor in all cases was trauma of the eyeball followed by hyphemia and impregnation of the cornea by blood from the anterior chamber. The onset of the staining of the cornea varied from five to fifteen days after the injury. In four patients the intra-ocular tension was normal; in one it was subnormal. Clinically, all cases resembled each other in appearance—disklike, greenish-yellow opacity with a peripheral transparent rim, the epithelium being uninjured. One of the eyes, which was painful within three weeks after the injury, was enucleated for fear of sympathetic iridocyclitis. The microscopic changes were as follows: At the limbus were seen occasional unchanged erythrocytes in both deep and superficial layers. About 0.5 mm. from the limbus, numerous, various shaped refractile granules, stained red by eosin, were situated among the corneal lamellae, and were

denser in the posterior layers of the cornea. There were also a few granules of hemosiderin. No inflammatory or degenerative changes were observed.

The author agrees with Roemer that the refractile bodies are precipitated albumin from the hemoglobin. A detailed review of the literature on the pathogenesis of this condition is given.

O. SITCHEVSKA.

General

RATIONAL EMPLOYMENT OF EYE-DROPS AND EYE-OINTMENT. E. OLAH, Am. J. Ophth. **15:** 510 (June) 1932.

The author describes experiments showing that drops and ointments instilled into the lower culdesac reach the upper culdesac in a very dilute form, if at all. He suggests that drops and ointments be placed under the upper lid. This can be done by pulling the outer third of the upper lid upward and outward while the patient looks downward.

W. S. REESE.

OPHTHALMOLOGY IN GENERAL PRACTICE. D. V. GIRI, Brit. M. J. **2:** 1101 (Dec. 17) 1932.

The author believes that the general practitioner will get little help from a superficial knowledge of ophthalmoscopy and refraction, and thinks these subjects should be left in the hands of the specialist. He then discusses the conditions which a practitioner is likely to encounter, such as birth injuries, ophthalmia neonatorum, gonorrheal conjunctivitis, iritis, primary congestive glaucoma and foreign bodies in the eye. He also discusses first aid in injuries, styes, burns, eyestrain and cataract.

The author states that as the laity are becoming better instructed in things medical, it takes it on itself to go directly to the specialist and overlooks the general practioner. He recommends that the general practitioner retard this tendency by acquiring a certain efficiency in a number of special branches, and then cases beyond this somewhat narrowed field should be immediately referred to the specialst.

A. KNAPP.

General Diseases

SCHÜLLER-CHRISTIAN SYNDROME: REPORT OF A CASE. W. HERZAU and H. PINKUS, Klin. Monatsbl. f. Augenh. **89:** 721 (Dec.) 1932.

Schüller, in 1915, and Christian independently in 1919, described a disease which was characterized by defects of the cranium, exophthalmos and diabetes insipidus. Rowland, in 1928, discovered disturbance of the lipoid metabolism as the etiology of this syndrome which he, therefore, classed as disseminated xanthomas and Chester as lipoidogranulomatosis. Other terms are Hand's disease, Gaucher's disease and Niemann-Pick disease. Folke Hensen compiled fifty-four cases, including three of his own observation; he termed the syndrome a special form of general xanthomatosis.

Herzau and Pinkus report the case of a boy, aged 6, who showed symptoms of polydipsia and polyuria, together with mental changes from

his third year of life on. Later, enormous enlargement of the penis, adiposity and enlargement of the liver occurred. The ocular symptoms were an ulcer and osseous fistula at the temporal canthus of the left eye, and exophthalmos, which increased from 2 to 7 mm. within two years' observation. A defect of the skull was felt in the median line above the lambdoid suture. Several smaller defects were discovered in the roentgenogram. No defect involved the internal table; the typical "map-shaped" appearance of the skull was absent, but the rarefaction progressed. Wassermann and tuberculin reactions were negative, and hypercholesteremia was absent.

Histologic examination revealed a xanthoma with foam cells, giant cells and lipoid macrophages. The elephantiasis of the penis, observed in this syndrome for the first time, was probably caused by xanthomatous processes which caused stasis of the lymph.

K. L. STOLL.

LEUKEMIC BILATERAL EXOPHTHALMOS. E. MESROPIAN, Sovet. vestnik oftal. **1**: 558, 1932.

In a child, aged 2, suffering from monocytic leukemia, bilateral exophthalmos developed within two days. There was marked chemosis; the cornea and iris were normal. Ophthalmoscopic examination revealed only a pale hue of the fundus. The spleen was greatly enlarged; the temperature was elevated to 103 F. The blood count was as follows: hemoglobin, 44 per cent; erythrocytes, 2,490,000; leukocytes, 93,900; lymphocytes, 18.5 per cent; monocytes, 64.5 per cent. The child was taken from the hospital in a semiconscious condition by the parents.

O. SITCHEVSKA.

Injuries

PENETRATING WOUNDS OF THE POSTERIOR CHAMBER OF THE EYE. W. A. GRAY, Brit. J. Ophth. **17**: 15 (Jan.) 1933.

The term "posterior chamber" is used by the author, apparently as synonymous with "vitreous." The paper is in two parts, clinical and experimental.

Fifty-three cases of wounds of the sclera and other coats of the eye exposing the vitreous are analyzed. In eighteen of these cases the wounds were in the region of the limbus, and in thirty-five cases were purely scleral. Most of the injuries were produced by fine fragments of steel which were heated and therefore sterile; four were caused by splinters of glass, one by a stone and one by shrapnel.

Prolapse of the vitreous was present to a marked degree in fourteen cases. Later infection occurred in two. There was loss of vitreous to a considerable degree in five cases. There was no clinical evidence that it led to an entrance to the interior of the vitreous of destructive germs. Phthisis bulbi occurred in three of the cases of scleral wounds. No case of acute infection was observed when the wound was scleral, exposing the vitreous. Threatened sympathetic ophthalmia occurred in five patients, four of whom had injuries in the region of the ciliary body.

The experimental work was done on rabbits. Virulent organisms were injected into the vitreous. A 100 per cent ratio of infection was

obtained. In a second group of rabbits a prolapse of the vitreous was secured by a small scleral incision, and in a third group variations were made to insure a wider exposure of the vitreous or to exclude some additional factor, such as the action of the lacrimal secretion or trauma. It was shown that the prolapsed vitreous has a considerable power of resisting infection. It was difficult to produce infection by flooding the surface of the vitreous prolapse with the same bacteria, even in greater concentration than those which produced destructive suppuration when injected into the vitreous. No satisfactory explanation of this was reached. After exclusion of merely mechanical factors there remains some significant difference in the resistance of the superficial and deeper layers of the vitreous.

W. ZENTMAYER.

"WHILE TAKING APART THE PLOW." H. FRENKEL, Arch. d'opht. **49:** 628 (Oct.) 1932.

The frequency with which intra-ocular foreign bodies occur in agricultural labor prompts the author to suggest some measures for their prevention. Perforating wounds of the eye with intra-ocular foreign bodies are much more frequent than is commonly thought and much more dangerous than those which occur in industry. There are two reasons for the increased danger in farmers. In the first place the injury may pass unnoticed by a man absorbed in his work, hardened to fatigue and pain and accustomed to disregard minor hurts. As a result, the seriousness of the condition is unrecognized until vision is lost or the infectious complications have begun. Further delay results in the time required in going from the local doctor to the ophthalmologist, and still more time passes if roentgenography is to be undertaken. The author cites a case which demonstrates the unreliability of the patient's history, the failure of roentgenography to detect a foreign body and the importance of the use of the magnet for diagnosis. In the author's series of cases, hammering on a plow was the most frequent cause of the accident. He presents comparative statistics which demonstrate a worse prognosis in farmers. To prevent the occurrence of these accidents, he believes that educational methods alone will be successful, and that for this purpose an appeal should be made to the interested organizations.

S. B. MARLOW.

ISOLATED RUPTURE OF THE IRIS FROM OCULAR CONTUSION. E. CECCHETTO and M. PAPAGUO, Ann. di ottal. e clin. ocul. **59:** 1010 (Nov.-Dec.) 1932.

The patient was struck on the right eye two days before being seen. Vision was 1/6. The chamber contained blood. Three ruptures of the iris were present just outside the sphincter. On transillumination, these appeared as portions of a clear ring, surrounding the intact sphincter region. The literature, including various theories as to the mechanism of rupture of the iris, is reviewed.

The author concludes that the force of the blow on the cornea with the miosis that followed forced the aqueous against the iris and caused it to rupture at one of its weakest points, just peripheral to the sphincter.

S. R. GIFFORD.

LESION OF THE EYES DUE TO ELECTROWELDING: REPORT OF A CASE. P. KNAPP and P. BÄCHTIGER, Klin. Monatsbl. f. Augenh. **89:** 456 (Oct.) 1932.

In 1927, numerous metallic foreign bodies became embedded in both corneas of a man, aged 27; the left cornea was almost impregnated. When the patient was reexamined in 1931, he complained of painful inflammation of the eyes for several weeks. Vision was reduced, and metamorphopsia existed in the better eye (the right), in the fovea of which a group of small, pink retinitic foci were observed. These changes were attributed to the effect of certain light rays emanating from an electrowelding machine. The patient stated that since he was a foreman he could not always wear a protecting helmet and dark glasses. Vision in the left eye had not changed since 1927. This was attributed to the impregnating film of metallic foreign bodies in the cornea acting as a protection to the fundus, which showed no pathologic changes. Vision in the right eye improved to the status of 1927 and the metamorphopsia disappeared after application of eight subconjunctival injections of physiologic solution of sodium chloride, but white dots could be seen in the macula four months later.

In an effort to establish the cause of this and similar cases and to facilitate decision in state compensation cases, Knapp undertook a series of experiments on rabbits' eyes. His results and those of Dr. Bächtiger of the Physical Institute at Basel are described in detail.

Autogenous welding with acetylene and oxygen did not produce lesions in the eyes of men or of animals if proper protecting glasses were worn. Electrowelding, however, sends forth ultraviolet rays and a number of other rays which, in all appearance, are harmful to the retina. Very dark glasses and a protecting helmet or shield are necessary to prevent lesions of the eyes and burns of the skin. Direct inspection of the retina under ultraviolet radiation showed only slight fluorescence. Two unilaterally aphakic persons, a man, aged 68, and a boy, aged 8, could see the iron lines in the ultraviolet portion of the spectrum distinctly up to 335 micromicrons and as uniformly violet above 450 micromicrons. The normal eyes of the authors could not see anything beyond 405 micromicrons. The perception of the retina of the aphakic persons was normal for the area up to 335 micromicrons, although vision was only two fifths of the normal. K. L. STOLL.

Lacrimal Apparatus

DISEASES OF THE LACRIMAL GLAND. J. IGERSHEIMER, Klin. Monatsbl. f. Augenh. **89:** 814 (Dec.) 1932.

Two cases of lesions of the lacrimal gland are presented by Igersheimer. A man, aged 39, had slight exophthalmos of one eye for a number of years. This suddenly increased with the onset of pain and inflammation in the region of the lacrimal gland. A roentgenogram revealed the presence of a mulberry-shaped calcification. This shadow remained unchanged, and a slightly tender mass was still palpable two years after the inflammation subsided. A detailed report will be published in the *Klinische Monatsblätter für Augenheilkunde.*

In the second case, that of a woman, aged 62, a slowly increasing, hard tumor was present for a year in the region of the lacrimal gland, extending toward the center of the upper palpebral margin. The patient suffered from deformation of the joints and hypertonia for many years, and from recurrent scleritis five years prior to observation by Igersheimer. The extirpated tumor was a lobular lymphoma; it contained remnants of tissue of the lacrimal gland. Examination of the blood revealed no abnormalities, except a conspicuous decrease of eosinophils.

K. L. STOLL.

THREE CASES OF LACRIMAL MUCOCELE. Y. SHOJI, Acta Jap. Ophth. Soc. **36:** 108 (Aug.) 1932.

The author believes that the definition of a lacrimal mucocele is indefinite. He thinks that it should mean a pathologic condition which leads to a bulging of the lacrimal region without any inflammatory symptoms. A number of photographs as well as roentgenograms made after the injection of iodized poppy seed oil 40 per cent in three cases are carefully described.

A. KNAPP.

Lens

THEORETICAL AND PRACTICAL STUDY OF THE INTRACAPSULAR CATARACT EXTRACTION. R. CASTROVIEJO, Am. J. Ophth. **15:** 406 (May) 1932.

The author comments on extracapsular and intracapsular extraction of cataract, and describes his own technic, which deviates little from that used by Elschnig and Barraquer. He concludes that the Smith method is inferior to the methods of Elschnig and Barraquer. In Elschnig's method, the capsule ruptures in 20 or 30 per cent of the cases. Castroviejo believes the Barraquer operation to be theoretically and practically the best, its only drawback being the cost of the instrument.

W. S. REESE.

FROM EXTRACAPSULAR EXTRACTION OF CATARACT TO INTRACAPSULAR EXTRACTION. VAN LINT, Arch. d'opht. **49:** 689 (Nov.) 1932.

This paper presents a description of the development of the intracapsular operation for cataract which is used by the author at the present time after a period of thirty years. The first modification of the classic operation, still described in most textbooks, was the introduction of the sliding conjunctival flap in 1911. In 1914, the author advocated paralysis of the lids by infiltration at the outer rim of the orbit to block the nerve supply of the orbicularis muscle. In 1918, he abandoned fixation with forceps in favor of Angelucci's suture in the superior rectus muscle. In 1922, he pointed out the advantages of Barraquer's method, but later gave it up. In 1924, he adopted Weill's method of making the incision with a keratome, enlarging it with blunt scissors. The use of the keratome led in 1926 to the making of a lateral incision combined with a conjunctival flap and the employment of Barraquer's instrument from the side, which made the operation easier

to do. Combined with this, he also employed retrobulbar injections to great advantage. In 1929, he advocated tarsorrhaphy in the after-care. His present method includes the following: akinesis, retrobulbar injection, anesthesia of the margins of the lid, the placing of three sutures in the lids, the introduction of a speculum, lateral incision with the keratome and scissors, iridectomy, extraction of the cataract by means of the vacuum cup, removal of the speculum, tying of the sutures in the lids, the administration of pilocarpine and the use of a binocular bandage for two days, and a monocular bandage until the fourth day, when dark glasses are given.

S. B. MARLOW.

ANATOMIC, ETIOLOGIC, EXPERIMENTAL AND CLINICAL STUDY OF RUPTURE AND TEARING AWAY OF THE ZONULE. FRENKEL AND DEJEAN, Arch. d'opht. **49:** 753 (Dec.) 1932.

In this paper the authors use the term "tearing away of the zonule" as indicating its separation from the ciliary body and rupture as meaning its separation from the lens. The literature contains little on this subject, almost no mention being made of it with the exception of the reference of Wagenmann. The embryology and anatomy of the zonule are discussed, especially in reference to the more recent work which has been done. Under the section of etiology, these lesions are discussed from the points of view of rarity of tearing away of the zonule, the importance of the variety of lesions associated and the mechanism of their production. In a section devoted to experimental research, the work of Berges is reviewed, and some personal experiments performed on freshly enucleated eyes are described. In a clinical section the medicolegal value of the diagnosis is pointed out and the clinical pictures distinguishing between the two lesions are described. Tearing away of the zonule is recognized clinically by the presence of shreds of zonule attached to the free border of the lens after a traumatism. The authors believe that this condition exists more frequently than is thought. Because of its embryology and anatomic structure together with the mechanics of the trauma, rupture of the zonule at its attachment to the lens is much more common than its tearing away from the ciliary body. Traumatism in an anteroposterior direction often results in rupture of the sclera, more rarely tearing of the zonule from the ciliary body. Oblique traumatism at the limbus or contiguous sclera more often results in hyphema, iridodialysis, radial tears of the iris, injuries to the lens and especially rupture of the zonule and subluxation of the lens. The authors point out the necessity of considering the possibility of tearing away of the zonule from the ciliary body in all cases of subluxation of the lens. In their opinion, it will be found more frequently than at present appears to be the case.

S. B. MARLOW.

Lids

BLEPHAROCHALASIS WITH STRUMA AND DOUBLE LIP: REPORT OF A CASE. K. HARTMANN, Klin. Monatsbl. f. Augenh. **89:** 376 (Sept.) 1932.

Only a few cases of blepharochalasis with struma and double lip have been reported since K. Ascher described the first case (*Klin. Monatsbl. f. Augenh.* **65:** 86, 1920). The author describes the case of

a girl, aged 12 years, who showed the first changes of the lids two years prior to observation. The skin of the lids was reddened, folded, limp and baggy. Folds of skin, lifted with the fingers, persisted. The levator palpebrae was normal in the right lid but slightly weakened in the left. Soft masses of fat, felt digitally beneath the skin of the upper lids, could be readily pushed back into the orbit. The skin of the face showed no signs of atrophy or enlarged blood vessels, nor were exophthalmos or pathologic ocular changes observed. The upper lip was enlarged, and a fold of the mucosa, adjoining the gums, could be noticed when the child talked or laughed. The thyroid was greatly hyperplastic and swollen; it was moderately hard, and its two lobes were equally enlarged; pulsation and bruit were absent. The sella turcica was normal, disturbance of the function of the thyroid was not present, and the general physical condition was perfect, except for slight cystitis. The blepharochalasis was treated by the excision of a broad flap of skin, removal of prolapsed fat and attachment of the tarsus to the point of origin of the levator according to Hytz' method. The etiology furnished no explanation of this syndrome, which may have been caused by a disturbance of the endocrine secretion.

K. L. STOLL.

Methods of Examination

A PRACTICAL DEVICE FOR RADIOGRAPHIC EXAMINATION OF THE OPTIC FORAMEN. R. ARGANARAZ, Am. J. Ophth. **15:** 230 (March) 1932.

This somewhat technical article suggests an ingenious method of taking x-ray pictures of the optic canals. The apparatus consists of a celluloid head clamp with two graduated semicircles. From the center of each semicircle projects a knob to the end of which is fastened a plumb bob line. This is placed on the patient's head so that one semicircle is at the top of the head and the other at right angle to it at the side of the head. The patient's head is placed over the x-ray plate and arranged so that each plumb bob line coincides with the 38 degree mark on the scale of each of the semicircles. This is the proper angle at which the x-ray pictures should be taken.

W. S. REESE.

NEW APPLICATION OF "PARADOXICAL VISION:" STUDY OF ASTIGMATISM BY MEANS OF THE "STAIR-CASE" PHENOMENON OF CHANOZ IN COLORED LIGHT. PONTHUS, Arch. d'opht. **49:** 717 (Nov.) 1932.

In a preceding article the author described the "stair-case" phenomenon as used in white light to determine the presence and position of astigmatism. In this article he applies the same principle to determine the kind of astigmatism. He reviews briefly the "phenomenon of paradoxical vision" first described by Peck in 1928. To apply this method of examination to the study of astigmatism, the author replaces the letters on the red and the blue screens with the circles and indicator devised by Chanoz. The combination of the two phenomena presents a good subjective test. If the eye is emmetropic, the test object will be seen equally clearly on the red and the blue screens. If the eye presents only a spherical ametropia, the "stair-case" phenomena will not appear on either screen, no matter where the indicator is turned. The eye

is myopic if the test object is seen more clearly on the red screen, and hyperopic if seen more clearly on the blue screen. If simple astigmatism is present the "stair-case" change appears sharply on the red screen if the astigmatism is hyperopic, and on the blue screen if it is myopic. The principal meridian lies where the indicator is seen very black and straight. Compound astigmatism is determined by first correcting the spherical error. Mixed astigmatism is similarly determined. The author believes this test to be accurate and simple.

S. B. MARLOW.

CINEMATOGRAPHY OF THE FUNDUS OF THE EYE. P. BALLIART, Presse méd. **41:** 337 (March 1) 1933.

The author of this article has been for many years one of the leaders in the study of the vessels of the fundus. The article records the work of the ophthalmologist, Lijo Pavia of Buenos Aires, who has succeeded after much care and patience in reproducing a moving picture showing the spontaneous pulsations of the arterioles near the macula in a case of senile macular lesion, and also the technic of producing arterial pulsations. The violence of the contracting artery is dramatically shown. These pictures were a part of the demonstration at the meeting of the International Congress of Ophthalmology in Madrid in April. The great value of moving pictures in the study of the eye is emphasized by the author.

L. L. MAYER.

CYCLOSKIASCOPY. W. ARKIN, Arch. f. Ophth. **129:** 115 (Sept.) 1932.

The author describes the skiascopic phenomena which occur if the mirror is rotated in a circle, that is to say, on an anteroposterior axis. J. H. Claiborne (*Tr. Am. Ophth. Soc.* **19:** 297, 1921) first advocated this method and interpreted the movements of the shadow. Cycloskiascopy is more difficult than the classic method of cylinder skiascopy with observation of the shadow movements in the two main meridians. Claiborne and Arkin believe that rotatory movements of the mirror give, in a few seconds, an approximate idea of the refractive state of the eye examined. They therefore advocate cycloskiascopy as a valuable first move in skiascopic work.

P. C. KRONFELD.

OPHTHALMOSCOPY WITH FOCAL ILLUMINATION. A. ZAMENHOF, Arch. f. Ophth. **129:** 149 (Nov.) 1932.

In 1930, the author described a modification of the simplified Gullstrand ophthalmoscope (*Arch. f. Ophth.* **124:** 87, 1930) which permitted observation of the fundus in well focused light. By putting an extra lens of +32 diopters in the course of the illuminating light rays of the Gullstrand, a sharp image of the slit of the Gullstrand was projected onto the plane of the image of the fundus. Next the author discusses in detail the conditions of observation with the new device which represents an application of slit-lamp technic to ophthalmoscopy. A large number of illustrations show typical fundus pictures as seen with the new technic. Most of the American ophthalmologists have been familiar with the advantages of focal ophthalmoscopy since J. Friedenwald brought out and taught the use of his ophthalmoscope.

P. C. KRONFELD.

VALUE OF SKELETON-FREE ROENTGENOGRAMS IN DEMONSTRATING THE PRESENCE AND LOCATION OF INTRA-OCULAR FOREIGN BODIES: REPORT OF CASES. F. STOCKER, Klin. Monatsbl. f. Augenh. **89:** 467 (Oct.) 1932.

Three cases are reported in which skeleton-free roentgenograms aided in the accurate localization of intra-ocular foreign bodies, after lateral and frontal exposures had failed to give evidence of their presence.

In the first case, the foreign body shown in the original cranial picture could not be found in the second because it had changed its position, as shown in the third exposure made by the skeleton-free method. In the second and third cases, films made by this method established the presence of foreign bodies in siderosis. In the second case, a splinter had lodged in the lens; it was extracted successfully. The third case is instructive as beginning siderosis was discovered when a man came to have a splinter removed. When questioned, the patient stated that he had felt something striking the same eye three months previously but that the eye had seemingly been well ten days later. Examination with the narrow slit of a Gullstrand slit-lamp showed that a faint scar had resulted from a penetrating wound. In discussing the superiority of the skeleton-free method, the author stresses the advantage of exposures made from the side and from above. He also points out the necessity of leaving the hooks in the conjunctiva, as a means of control during the operation by comparison with the roentgenograms.

K. L. STOLL.

Neurology

BILATERAL FACIAL SPASM. H. L. PARKER, Am. J. Ophth. **16:** 28 (Jan.) 1933.

The author speaks of the different types of facial spasm and reports two cases of bilateral spasm, one in a woman aged 70 and the other in a man aged 38. The woman exhibited Parkinson's syndrome. Her speech was slow and monotonous, and there was tremor of the right lower extremity. Ocular movements were slow, but between the spasms the patient could look up or laterally; looking down immediately brought on a spasm. These spasms were at first intermittent but within a few years had become continual, of varying intensity, so that the patient was practically blind. In the man the first spasm came on suddenly while he was eating dinner. There was no associated mental or physical cause. The spasms occurred several times a day but finally became continual. As in the case of the woman, the spasm first involved the lids, but the other facial muscles soon became involved and the patient became practically blind. Physical examination revealed some carious teeth and infected tonsils. There was some suggestion of rigidity in the general movements and very slight reduction in the speed of motion of the right hand. Laboratory examinations, including a Wassermann test, gave negative results.

The author reviews many reported cases and gives the following summary and conclusions: 1. The condition of two patients suffering from bilateral facial spasm or paraspasm is described. 2. One patient

was obviously senile and had a well marked Parkinson syndrome; the other patient was of middle age, and clinically the condition suggested very early Parkinson syndrome of the encephalitic type. 3. Two main causes for the disease apparently are senility or arteriosclerosis of the brain and epidemic encephalitis. 4. The condition is extremely distressing; it seems to persist indefinitely, and curative measures are unknown.

W. S. REESE.

ENCEPHALOMYELITIS OPTICA ACUTA: REPORT OF A CASE. J. KLAR, Klin. Monatsbl. f. Augenh. **89:** 645 (Nov.) 1932.

The author reports four cases of acute optic encephalomyelitis, a form of disseminated encephalomyelitis. This is a severe acute disease of the retrobulbar portion of the optic nerve, occurring first in one and then in the other eye. Choked disks cause usually total, but transient, amaurosis, resulting after weeks or months in recovery, with functional defects, which, however, may be missing occasionally. The ocular symptoms usually precede other manifestations of inflammatory disease of the central nervous system, e. g., of the optic tract, the chiasm, the pyramidal tracts and the spinal medulla.

The patients included a girl, aged 13, two women, aged 27 and 32, and a woman, aged 37, who was pregnant. Among the ocular symptoms were noted binocular defects of the right lower quadrants of the field of vision, extending upward and downward in the periphery in the shape of a crescent in two patients, relative scotoma, homonymous hemiamblyopia for colors, visual deficiency and choked disks. The author considers this combination of disturbances in the optic stem and optic tract valuable in differentiating acute optic encephalomyelitis from disseminated sclerosis. He thinks that the choked disks in his cases were not local inflammations but were caused by close proximity to the globes of the foci in the optic nerve. Disseminated disease of the central nervous system was evidenced by absence of the Babinski, Gordon and Oppenheim reflexes, by anesthesia and analgesia of the dorsal segment and by paralysis of the bladder and the rectum. Furthermore, there were deflection of the tongue to the left side, clonic increase of the patellar, achilles, radial and triceps reflexes, paresthesias and twitching of the legs.

Increased pressure of the spinal fluid was found in none of these four cases, nor was exposure, injury, syphilis or any other infectious disease a possible etiologic factor. No information could be gained as to the possible immunity of these four patients to recurrences. The inflammatory nature of the disease seems to be established by the temperature curve and by the positive reaction to globulin and slight pleocytosis of the spinal fluid.

K. L. STOLL.

DEXTROSE IN INCREASED INTRACRANIAL PRESSURE: REPORT OF A CASE. J. IGERSHEIMER, Klin. Monatsbl. f. Augenh. **89:** 813 (Dec.) 1932.

The author reports the case of a woman, aged 36, who presented symptoms of increased intracranial pressure. He diagnosed an inflammatory meningeal process, although choked disk of 7 diopters and prominence in both eyes had suggested the presence of a brain tumor at first.

Spinal fluid, taken by lumbar puncture, was clear but showed positive reaction after the Nonne-Apelt test. The Wassermann reactions for the blood and the spinal fluid were negative. After treatment with tapping, mercury and iodine had failed, 60 cc. of a 50 per cent solution of dextrose was given intravenously three times in intervals of a few days. This treatment, devised by Weed and McKibben in 1919, proved its merit in this case; perfect recovery from all the symptoms, including the choked disks, followed.

Igersheimer considers the intravenous injection of dextrose a valuable treatment, once or repeatedly applied. He also considers it of value in the differential diagnosis between meningitis serosa or hydrocephalus and brain tumor.

K. L. Stoll.

Orbit, Eyeball and Accessory Sinuses

A Case of Marked Bilateral Exophthalmos Due to Lesions in the Region of the Hypophysis: Cure by Mercurial Treatment Combined with High Voltage Roentgen Therapy. Delord, Arch. d'opht. **49:** 799 (Dec.) 1932.

In this report a case is described in detail of a patient who had a marked bilateral exophthalmos with chemosis of the conjunctiva and keratitis lagophthalmos in one eye. General examination gave entirely negative results, including the Wassermann test of the blood, except for roentgenographic changes in the sella turcica. Complete cure resulted from the use of high voltage roentgen therapy and the administration of mercury. The author reviews the various hypothetic possibilities of causation and calls attention to similar cases which have been described in the literature. Because of the rapidity of the improvement, which the author attributes to the mercurial treatment, he believes the probable nature of the lesions present in the case reported to be syphilitic.

S. B. Marlow.

Pharmacology

Effect of Epinephrine Instillation on Iris of Normal Animals. M. MacK. Sawyer and T. Schlossberg, Am. J. Physiol. **103:** 153 (Jan.) 1933.

Sawyer and Schlossberg state that epinephrine hydrochloride, if instilled for a sufficiently long time into the conjunctival sac of normal cats or rabbits, exerts an effect on the muscles of the iris. In cats, minimal doses cause a constriction of the pupil. Larger amounts produce a distinct mydriasis in the treated eye, which is in some cases preceded and followed by a period of contraction. Previous removal of the nictitating membrane in cats greatly increases the effect of epinephrine hydrochloride instilled into an otherwise normal eye. The authors took measurements of the pupils by means of a millimeter scale held close in front of the eyes and at right angles to the vertical pupillary opening. The eyes were subjected to a standard illumination. The solutions of epinephrine hydrochloride for instillation were freshly prepared for each experiment; dilutions of 1:10,000 and 1:2,000 were

employed. The solution was instilled into only one eye; the other was used as a control. The instillation was made by holding the eyelids apart and dropping in a sufficient amount of solution to flood the eyeball. Every few minutes the instilled solution was removed by wiping the eye with cotton and fresh drops were added. The time during which the solution was kept in contact with the conjunctiva varied from five to thirty minutes. The intravenous injection of epinephrine hydrochloride into a normal animal that showed contraction of the pupil of one eye as a result of a previous instillation of epinephrine hydrochloride produced a more striking and more persistent mydriasis in that eye than in the normal one. The intravenous injection of epinephrine hydrochloride into a normal animal that showed dilatation of one pupil as a result of a previous instillation produced a more marked mydriasis in that eye than in the other eye. In this instance the mydriasis of the treated eye persisted for a long time after the normal pupil had reached its original diameter. [J. A. M. A.]

MANOMETRIC EXAMINATION OF OCULAR PRESSURE AND BLOOD PRESSURE IN INTRAVENOUS AND SUBCONJUNCTIVAL ADMINISTRATION OF VARIOUS MEDICINES: VI. AMYL NITRITE. K. IMACHI, Acta Jap. Ophth. Soc. **36:** 102 (Aug.) 1932.

The author studied the variations in ocular pressure and in blood pressure in rabbits after intravenous injections of 0.05 cc. of amyl nitrite for each kilogram of body weight. Similar experiments were made by injecting 0.1 cc. of 0.1 per cent solution of epinephrine and 0.5 cc. of pituitary extract subconjunctivally before the amyl nitrite. The changes in the blood pressure in all the rabbits were practically the same. After the intravenous injection of amyl nitrite, the blood pressure undergoes a striking and rapid decrease of from 40 to 70 mm. of mercury, and then gradually rises again. This is explained by the preliminary general dilatation of the peripheric blood vessels. The ocular pressure at first rose from 20.4 to 23.4 mm. of mercury and then dropped somewhat. After a second short rise there was a gradual descent, so that in the first series the ocular pressure was 8.5 mm. of mercury lower than the beginning pressure; in the second series, 7 mm. of mercury, and in the third series, 9.8 mm. of mercury. The beginning increase in the ocular pressure could be brought in relation to the dilatation of the intra-ocular vessels. The second gradual sinking can be explained by the increase in the viscosity of the blood. This increase in viscosity acts by abstracting water out of the eyeball and retards the production of the aqueous. The dilatation of the pupil showed no variation. A. KNAPP.

Physiology

THE CHEMICAL CONSTITUTION OF THE CORNEA. A. C. KRAUSE, Am. J. Ophth. **15:** 422 (May) 1932.

This technical article does not lend itself to abstracting. The author discusses the difficulties of the analyses of the chemical constitution of the cornea and methods of overcoming these difficulties. He gives three tables summarizing his findings. W. S. REESE.

THE NATURAL IMMUNITY OF THE CONJUNCTIVA IN RELATION TO BLOCKING OF THE RETICULO-ENDOTHELIAL SYSTEM WITH TRYPAN BLUE. R. GALLENGA, Arch. di ottal. **39:** 411 (Aug.) 1930.

In a previous article the author reported that rabbits given intravenous injections of trypan blue showed a marked reduction in resistance to virulent organisms introduced into the conjunctival sac. They also showed general toxic effects from the drug. In subsequent work rats and guinea-pigs were subjected to the same procedure, but showed neither a reduction in resistance nor any toxic effects of the drug. The author concludes that the results obtained in rabbits were not due to decreased local immunity from blocking of the reticulo-endothelial system, but resulted from the general effects of the drug on the rabbit.

S. R. GIFFORD.

PRESSURE-REDUCING FACTORS IN SO-CALLED OSMOTIC HYPOTONIA. F. POOS, Klin. Monatsbl. f. Augenh. **89:** 145 (Aug.) 1932.

Hertel's fundamental research on rabbits, corroborated by other authors, furnished proof that sudden and major changes in the composition of the blood produce transient, and under certain circumstances considerable, changes in the intra-ocular tension. Hertel produced these changes in the blood by intravenous injections of varying concentrations of solutions of sodium chloride, sulphate and phosphate, butyric and isovalerianic sodium, dextrose, urea, water, gelatin, egg yolk or albumin, human or horse serum and blood.

Poos repeated these experiments on rabbits with various substances, obtaining the following results: Blood albumin entering the anterior chamber after the intravenous injection of hypertonic solutions of neutral salts, dextrose, sodium fluorescein, urea and albumin produced a lesion of the capillaries. This lesion caused a considerable increase of the permeability of the membrane separating blood and aqueous humor. Doses of all these solutions, incompensable for the intra-ocular tension, produced the same histologic changes; they were considered as the result of disturbances of the capillary circulation, developing after the permeability of the walls of the capillaries was increased to such an extent as to allow the escape of albumin. General edema of the ciliary processes, Greeff's vesicle, prestatic circulation, deposits of albumin and cells in the anterior chamber and, later, leukopedesis and erythrodiapedesis into the tissues are the consequences of these processes.

Poos found that the actual osmotic differences between blood and intra-ocular fluid are not at all proportionate to the amount of the decrease of the tension of the globe after injections of hypertonic solutions, and that they are of negligible consequence in so-called "osmotic hypotonia," as compared with the other factors which produce decrease of tension. This was evidenced by the observation that the active osmotic differences between the pressure of the blood and the intra-ocular fluid showed no correlation with the amount of the decrease of the intra-ocular tension after injection of hypertonic solutions. No proportion was found between the decrease of the intra-ocular tension and the effect of the differences in osmotic pressure, while a proportion existed between the degree and duration of the hypotonia and the toxicity of the injected substances.

Toxicity was not observed after a single injection of a solution of sodium chloride, corresponding to the watery contents of hypertonic solutions, nor was it seen after the injection of higher concentrations of dextrose. The toxicity was increasingly higher with calcium chloride, urea and comparatively small doses of foreign serum, in the order mentioned. The complete softening of the globe, produced by intravenous injections of large quantities of physiologic solutions of sodium chloride, followed by an acute insufficiency of the capillary circulation in the globe, shows that it is possible to soften a globe completely without the aid of artificially produced osmosis. The action of the blood vessels is the real cause of hypotonia after the injection of hypertonic solutions. This fact is proved by the observation that, after the ligation of both carotids and the injection of a hypertonic solution into one of them, the eye on the side of the injection shows direct protracted hypotonia without preceding hypertonia, while the other eye remains practically unaltered. Intravenous injections, furthermore, of comparatively small quantities of solutions of albumins and serums are capillarotoxic and produce extensive softening of the eye with corresponding histologic changes, but no decided secondary osmotic differences in pressure. In conclusion, Poos states that so-called "osmotic hypotonia" cannot be separated from the other experimentally produced forms of hypotonia.

K. L. STOLL.

Refraction and Accommodation

TEMPORARY CHANGES IN THE REFRACTION OF THE EYE IN DIABETICS. R. AFFLECK GREEVES, Brit. M. J. **2**: 963 (Nov. 26) 1932.

A report is given of two middle-aged persons with diabetes whose refraction had repeatedly changed, and the examination of the urine showed the presence of advanced diabetes.

The first patient was a woman, aged 50, in whom 3 diopters of myopia developed, the correction of which made her vision normal. The media were clear. The urine contained sugar, and the blood sugar was 220. After treatment with insulin, the blood sugar became normal, and the myopia was reduced by 1 diopter in each eye.

The second patient was a woman, aged 58, who presented a myopia of 1.5 diopters in each eye, which, corrected, gave her normal vision. The urine was loaded with sugar, and the blood sugar was 258. She was treated without insulin; her blood sugar became normal, and all traces of myopia disappeared.

The author describes the transient refractive changes in persons with diabetes, referring particularly to the paper of Duke-Elder (*Brit. J. Ophth.* **9**: 167 [April] 1925) and discusses what is known about the causative agent. He concludes as follows:

1. Transient myopic and hypermetropic changes in the refraction of the eyes occur in association with certain metabolic disturbances.

2. A remarkable relation seems to exist between those refractive changes and the blood sugar concentration.

3. The local cause of these variations in refraction is most probably a variability in the refractive index of the lens.

4. The underlying complex biochemical causes are still obscure.

A. KNAPP.

Retina and Optic Nerve

EMBOLISM OF THE CENTRAL RETINAL ARTERY. GEORGE YOUNG, Brit. M. J. **2:** 878 (Nov. 12) 1932.

A woman, aged 70, was operated on for cataract in one eye in July, 1930. On October 8, the sight in this eye totally failed, with the picture of embolism of the central retinal artery and the cherry colored spot at the macula. The patient had an "organic heart." Pilocarpine, 2 per cent, was instilled, and in ten minutes the procedure repeated, followed thirty minutes later by vigorous massage of the eye for five minutes. This was repeated three times on the following day, and after the morning massage on October 10 vision returned. The treatment was continued, and on October 12, the retinal arteries were restored to their normal size, and vision was as good as ever.

A. KNAPP.

THE TREATMENT OF DETACHMENT OF THE RETINA BY PERFORATING DIATHERMIC COAGULATION. GENET, Arch. d'opht. **47:** 710 (Nov.) 1932.

This form of treatment of detachment of the retina is discussed from three points of view: (1) the reasons for the use of diathermy, (2) the operative technic and (3) the results obtained. In some cases of detachment tears are not found. By the use of diathermy in a dosage sufficient to produce coagulation without producing a burn, the author attempts to produce adhesions between the retina and the choroid, at the same time making an effort to close the tears that may be present. He describes the procedure used to accomplish this: The needle is plunged through the sclera into the pocket formed by the detachment; the current is then turned on for two seconds. The withdrawal of the needle is sometimes followed by some subconjunctival infiltration of fluid. It is only when the eye is soft and the needle does not penetrate easily that the conjunctiva is dissected away and the sclera incised with a knife. Several punctures may be made at one operation, for which a local anesthetic is sufficient. The patient may experience some unpleasant sensations when the current is applied. The author has never seen any postoperative complications or scars. In order to reach the equator, he incises the conjunctiva and rotates the eye by means of a strabismus hook placed under a muscle. He describes his method of testing the spark before doing the operation. Fourteen cases are reported with favorable results.

S. B. MARLOW.

MYOPIC DETACHMENT OF THE RETINA CURED BY THE METHOD OF SOURDILLE. DUPUY D'UBY, Arch. d'opht. **49:** 185 (March) 1932.

The author has treated four patients with detachment by multiple punctures, using Sourdille's method. Two were failures and one resulted in reattachment without improvement in vision. The fourth case showed a complete cure and is reported in detail. The condition had remained unchanged at the end of a year. In this case a tear was seen before operation. After operation it was noted for some time,

although there had been an effort to make one of the punctures in its vicinity. The necessary prolonged immobility after operation is extremely trying to the patient; consequently the author believes it essential to warn the patient about it.

S. B. MARLOW.

OPTIC ATROPHY FOLLOWING RETINAL ANGIOSPASM IN ANGINA PECTORIS. C. DEJEAN, Arch. Soc. d. sc. méd. et biol. de Montpellier **13:** 505, 1932.

In the case reported, in two attacks of angina transitory blindness affected the right eye, and in a third crisis the vision was permanently lost. The left eye remained normal. The right eye could barely perceive light, and its visual field was reduced to a crescent between 10 and 20 degrees. The retinal arteries were thready and the disk was exsanguinated and atrophic. The author believes that the prolonged spasms produced parietal lesions in the retinal arterioles, as a result of which obliteration finally ensued.

J. E. LEBENSOHN.

SENILE RUPTURE OF THE MACULA. E. FEDERICI, Arch. di. ottal. **39:** 365 (Aug.) 1932.

Two cases of senile rupture of the macula are reported. One patient complained of sudden loss of vision in one eye and showed edema of the macular region with thin retinal arteries and pallor of the disk. Two months later, a typical hole in the macula was present. In the other patient a similar edema and macular hole were present at the first examination a month after the first visual disturbance. No causative factor except generalized arteriosclerosis was found in either case.

In a third case a hole in the macula occurred as part of a syphilitic retinitis. The author believes that the edema, caused in the first two cases by interference with the circulation and in the third by inflammation, was the cause of the macular holes. A bibliography is appended.

S. R. GIFFORD.

IS OGUCHI'S DISEASE LIMITED TO THE MONGOLIAN RACE? REPORT OF A CASE. K. BEIN and L. MICHNIEWICZ, Klin. Monatsbl. f. Augenh. **89:** 640 (Nov.) 1932.

A healthy Polish farmer, aged 23, was night-blind from early childhood. He was never sick. There was no marital consanguinity in the family, and none of the other members presented night-blindness. Vision and the visual fields for white were normal, but for blue, red and green the fields were nearly as large as for white. Sensitivity to light was 6 per cent of the normal and remained so after three hours' complete dark-adaptation when measured with Birch-Hirschfeld's photometer. The disks and the peripheral districts of the fundus appeared normal. The macula, normal before dilatation of the pupil, appeared as a red spot, as well defined as it is in edema of the retina. The upper temporal and the temporal portion of the upper nasal quadrant of the fundus appeared golden-yellow and the design of the choroid was not discernible. The arteries and veins were of the same cherry-red hue; they could be traced to their fine ramifications and gave the appearance

of greater vascularization in this region than in the other portions of the fundus. The golden-yellow area was not well defined; its boundaries disappeared gradually in the color of the surrounding normal fundus. The retinal reflexes remained normal during the observations. After another three hour test of dark-adaptation under a binocular bandage, none of these changes in the fundus could be seen except that the design of the choroid remained invisible; they reappeared after the patient had rested for one-half hour in a small room lighted by 300 units of illumination. The second test began two hours after sunset; the first was made at noon.

This case, in the author's opinion, is another instance of Oguchi's disease with Mizuo's phenomenon occurring outside of Japan. The extraordinarily large fields for colors, especially for green, would correspond with the anatomic finding by Oguchi of predominance of the cones. Referring to similar conditions found by Scheerer in a German and by Endelman in two Jews, the authors conclude that Oguchi's disease is not limited to the Mongolian race.

K. L. STOLL.

SENILE DEGENERATION OF THE MACULA: A REPORT OF TWO CASES. T. KONDO, Acta Jap. Ophth. Soc. **36:** 152 (Dec.) 1932.

In the cases reported the macular region was occupied by a bluish-white area made up of many small dots. The author believes that the bluish tint of this area is due to the strongly pigmented eyeground, just as the veins appear blue through the skin. Surrounding the area the choroid is atrophic and the choroidal vessels are sclerosed; the condition can be particularly well observed by means of long-wave light. Sclerosis of the choroidal vessels is believed to be the fundamental change.

A. KNAPP.

Trachoma

CONTRIBUTIONS TO THE KNOWLEDGE CONCERNING THE BACTERIUM GRANULOSIS. B. KANYÓ and A. RÖTTH, Arch. f. Ophth. **129:** 97 (Sept.) 1932.

The authors succeeded in obtaining pure cultures of Bacterium granulosis from two of fifteen cases of human trachoma, and in three of six cases of human folliculosis. The strains obtained from the patients showed the same features as three original strains of Noguchi, which the authors received from the Rockefeller Institute. The identity of the two groups of strains was also shown by immunization of rabbits and cross-agglutination tests with the serum of the immunized animals.

The serum of patients with acute or chronic trachoma or folliculosis did not agglutinate emulsions of cultures of Bacterium granulosis. The bacterium was not pathogenic to laboratory animals except for their conjunctivae. Subconjunctival injection of the bacterium produced nodules without diffuse infiltration in rabbits, and nodules with diffuse infiltration in dogs. These changes disappeared without treatment within from six to eight weeks. The authors also observed spontaneous folliculosis in dogs, rabbits and monkeys.

P. C. KRONFELD.

MICROSCOPIC DIAGNOSIS OF TRACHOMA. J. TABORISKY, Folia orient. ophth. 1: 34, 1932.

Microscopic signs of trachoma require bacteriologic, cytologic and histologic examination.

1. Bacteriologic: The microflora in trachoma does not differ from that of the normal eye. The finding of scanty bacteria increases the possibility of trachoma. Mixed infections are not rare.

2. Cytologic: Epithelial scrapings are preferable to smears. The cylindric epithelial cells are early transformed into pavement forms. Certain peculiar alterations occur in the nuclei. The epithelial inclusion bodies are pathognomonic and appear early, but may disappear after a year or so.

3. Histologic: Characteristic changes in trachoma are transformation, degeneration and proliferation of the epithelium, combined with pathologic changes in the subepithelial tissue. In follicular catarrh, the follicles lie superficially or in the deeper layers; in trachoma, close under the epithelium. In each disease the composition of the follicles differs.

G. M. BRUCE.

Tumors

DIFFICULTIES AND ERRORS IN THE DIAGNOSIS OF SARCOMA OF THE CHOROID: REPORT OF CASES. P. A. JAENSCH, Klin. Monatsbl. f. Augenh. 88: 622 (May) 1932.

The diagnosis of sarcoma of the choroid may become difficult, or even impossible, if complicated by iridocyclitis, exudations, occlusion of the pupil or cataract. Diascleral transillumination may be rendered equally difficult by these complications. Erroneous enucleation in such cases may not be of consequence because eyes of such a nature are usually blind and painful. Jaensch reports five cases which offered great diagnostic difficulties. On admission they presented the triad of tenonitis described by Birch-Hirschfeld: moderate exophthalmos, chemosis and painful inhibition of motility. Obstructions in the anterior chamber or pupil prohibited ophthalmoscopic examination.

The course of the disease, the anamnesis, which differed considerably in these cases, and the small number of histologic examinations of tumor-tenonitis hitherto published prompted the author to report the case histories in detail.

Sclerectasia by force of the tumors was absent in the five cases. Lymphocytic infiltration of the choroid, extending by way of the vessels or nerves into Tenon's space and into the retrobulbar tissues, was present in each instance. Four cases showed abnormal metastases in the optic nerve and the lamina cribrosa, which usually resists the advance of the sarcoma for a long time. Numerous tumor strands stretched in one eye from the disk through the lamina into the optic nerve. Necrosis of the tumors was found, but its cause, explained by malnutrition of the tumors, could not be recognized in the slides. The five tumors were attached to the sclera on a broad base.

A sixth eye, enucleated for suspected sarcoma, proved to harbor an angioma of the choroid, 1 cm. in length and from 1 to 1.5 mm. in thickness. The overlying retina was transformed into a multicellular cyst.

K. L. STOLL.

Visual Tracts and Fields

INVESTIGATION OF THE VISUAL FIELDS UNDER CONDITIONS OF LOWERED OXYGEN TENSION. H. GOLDMANN and G. SCHUBERT, Arch. f. Augenh. **107**: 216, 1933.

The investigations which the authors report concern changes in the visual fields under lowered oxygen tension, simulating conditions encountered while flying at high altitudes. The following experiments were undertaken:

1. The limits of the visual field for black on a white background were determined in a low pressure chamber.

2. The fields were taken with the subject breathing in a Krogh spirometer. The oxygen tension was gradually reduced while the carbon dioxide was absorbed with soda lime.

3. In a further series, a mixture of oxygen and nitrogen was breathed by the subject, and the visual fields for form and color and the blind spots were determined. The authors find that by lowering the oxygen tension of atmospheric air either by lowering the air pressure or by breathing mixtures of oxygen and nitrogen (less than 12 per cent oxygen) there regularly occurs a contraction of the visual field in the upper and nasal quadrants. The field rapidly returns to normal when the normal oxygen tension is reestablished. The lower the oxygen tension the more marked is the contraction of the field. An enlargement of the blind spot was also regularly observed.

The nasal contraction of the field may have its origin in the retina. One can best explain the irregular contraction by assuming that different parts of the retina have different volumes of blood supply. The contraction of the visual field could not have its cause in the brain, for any cerebral disturbance must lead to either a concentric or a homonymous hemianopic change. There are, of course, three possible explanations why this part of the retina should suffer more than others: 1. The blood supply of the retina may be equal throughout, but different portions are more sensitive to lack of oxygen than others. 2. The vascularity may be equal throughout, but the threshold of sensitivity of the temporal portion of the retina may be higher than that of the nasal portion. When there is a gradual reduction in sensitivity throughout, as by lack of oxygen, the temporal periphery is the first to suffer. 3. The temporal periphery may not have as good a blood supply as the nasal periphery, so that a reduction in the oxygen tension is first felt in the temporal periphery. The authors believe that the third explanation is the correct one.

F. H. ADLER.

CONTRIBUTION TO THE STUDY OF GRAVIDIC BITEMPORAL HEMIANOPIA. N. SHIMKIN, Folia ophth. orient. **1**: 90, 1932.

On the basis of six reported cases and one of his own, the author concludes as follows:

1. Hemianopia develops in direct relation with and proportion to the pregnancy.

2. At the artificial or natural termination of the pregnancy, the visual field enlarges. At each subsequent pregnancy, however, the hemianopia returns, and tends to become more and more stationary.

3. Visual acuity is diminished, and in nearly every case a degree of primary optic atrophy appears in one or both eyes.

4. Hemianopia is due to pressure of the hypertrophied pituitary body associated with a hypophyseal adenoma. This tumor exists before pregnancy in the primipara and develops during pregnancy in the multipara.

G. M. BRUCE.

Sympathetic Ophthalmia

A CASE OF SEVERE SYMPATHETIC INFLAMMATION BROUGHT TO A SUCCESSFUL CONCLUSION. J. H. FISHER, Brit. J. Ophth. **17:** 35 (Jan.) 1933.

This case is reported as an encouragement to surgeons confronted with the results of severe sympathetic ophthalmitis.

A boy, 11 years of age, suffered a penetrating wound of the right eye. About four or five weeks later the surgeon removed the eye. The left eye then became inflamed. Two years later the patient was seen by the author. There was still some deep congestion, with much gross "keratitis punctata." Tension was —1.5, and the globe was squared by pressure of the recti muscles. There was a total posterior synechia, and the pupil was blocked. After twelve weeks of treatment, vision equaled perception of light. Tension was less than 10 (McLean).

Six years later, there still being fair projection of light in the temporal field, after a cataract incision, an iridectomy was attempted with poor success. An attempt to scoop the lens failed because it was enclosed by a tough organized diaphragm. This membrane was split peripherally, with the point of a Graefe knife, following the line of the corneal section. Some grumous, semisolid, cheesy looking material exuded. The lens was straddled by the blades of capsule forceps and lifted out. No unfavorable reaction followed, though the upward coloboma closed and the iris became completely updrawn.

About six months later an iridotomy with deWecker's scissors was made, leaving a central, natural appearing artificial pupil.

More than five years later the vision with a + 18 D. spherical lens equaled 6/36, and Jaeger's test type 1 was read fluently with a +28 D. spherical lens. The visual field was slightly contracted. The details of the fundus could be dimly seen. The eye was still squared, with a tension of from —1 to —1.5.

W. ZENTMAYER.

THE RETINAL CHANGES IN SYMPATHETIC OPHTHALMIA. A. SCHREIBER, Arch. f. Ophth. **129:** 127 (Sept.) 1932.

In W. A., a woman, aged 66, sympathetic ophthalmia developed after complicated extraction and needling of a cataract. The sympathizing eye had to be enucleated because of very painful secondary glaucoma and poor projection of light. The eye on which operation was performed finally recovered with a visual acuity of 0.5. Sympathizing eyes are always more suitable for pathologic studies because they present the pure picture of sympathetic ophthalmia. In the aforementioned case, the severe uveitis in the second eye was limited to the iris, and became moderate in the ciliary body and slight in the choroid. The choriocapil-

laris was free of any pathologic changes. The retina, however, showed a striking degree of inflammatory and degenerative changes; the former consisted of periphlebitis and periarteritis, most pronounced at the disk and gradually lessening toward the ora serrata. The degenerative changes involved the whole retina and were, in spite of the normal choriocapillaris and the normal pigment epithelium, most marked on the rods and cones in the posterior segment which were transformed into a thin layer of albuminous substance.

Two other cases of retinitic and degenerative changes in sympathizing eyes showed a similar discrepancy between the degree of the choroidal and the retinal changes. The author believes that the severe retinal changes are remote toxic effects of the iritis, as he has found them, for instance, in a case of uncomplicated hypopyon keratitis. He also believes that the severe retinal process can serve as a valuable diagnostic sign of sympathetic ophthalmia in the second or sympathizing eye.

P. C. KRONFELD.

THREE CASES OF SYMPATHETIC OPHTHALMIA IN WHICH CURE WAS OBTAINED WITH A MIXTURE OF CINCHOPHEN AND SALICYLIC ACID. A. WACHENDORF, Klin. Monatsbl. f. Augenh. **90:** 81 (Jan.) 1933.

Stock recently reported favorable results obtained in cyclitides by intravenous injections of a solution consisting of equal parts of cinchophen and salicylic acid. Wachendorf used this preparation in three cases of sympathetic ophthalmia, which developed a few days after an injury in two of them and after thirty-eight years in the third. The diagnosis was ascertained by histologic examination in two of the cases. The results were satisfactory with preservation of the sympathetic eyes. Untoward complications, such as lesions of the liver, reported recently after the use of the solution of cinchophen and salicylic acid, were absent. The author recommends intravenous injections, daily or every second day, until certain improvement has resulted, after which series of three injections should be given in case of exacerbation or slowness of recovery.

K. L. STOLL.

Therapeutics

THE TREATMENT OF HERPES CORNEAE WITH THE STEAM CAUTERY OF WESSELY. J. VAN MANEN, Arch. f. Augenh. **107:** 254, 1933.

Van Manen points out that the treatment of herpes with the usual medicaments is unsatisfactory. Application of tincture of iodine, iontophoresis with zinc, application of absolute alcohol, ultraviolet irradiation and abrasion of the cornea have been recommended but are seldom effective. There have been but two reports in the literature concerning the treatment of herpes corneae with the steam cautery of Wessely which, as used by van Manen, has been very successful. The cautery is kept at a constant temperature of 98 C. by means of steam. The cornea is anesthetized with 2 drops of 5 per cent cocaine, and the point of the cautery is applied to the site of the herpes for a few seconds. The epithelium comes off and leaves a grayish-white defect. A 0.25 per cent scopolamine ointment is put in the culdesac. In the majority of cases the epithelium healed within twenty-four hours and the herpetic

lesions disappeared. In thirteen uncomplicated cases normal vision was maintained.

This treatment has two effects: The epithelium over the herpetic lesion is destroyed, and the temperature which accomplishes this destruction kills the herpes virus. For further reference on the use of the cautery, see Sommer (*Ztschr. f. Augenh.* **56:** 90, 1925).

F. H. ADLER.

INJECTION OF THE PATIENT'S OWN BLOOD INTO THE ANTERIOR CHAMBER IN TUBERCULOSIS OF THE ANTERIOR PORTION OF THE EYEBALL. F. SCHIECK, Klin. Monatsbl. f. Augenh. **90:** 1 (Jan.) 1933.

The author injected blood taken from the patient's brachial vein into the anterior chamber of the eyes of nineteen patients, fifteen of whom suffered from acute tuberculous disease of the anterior chamber and adjoining tissues. Two of the fifteen have not been observed sufficiently long to allow definite conclusions. The remaining thirteen patients remained free from recurrence of iridocyclitis after the injection, prior to which they had returned to the clinic repeatedly. They were considered cured, although a recurrence is technically possible so long as simultaneous treatment with tuberculin has not definitely increased resistance to the tubercle bacilli in the body.

No adverse complications were noted after the injections, if they were repeated several times on the same eye. Coagulation of blood on the anterior capsule of the lens and slow absorption of blood in the anterior chamber never raised the intra-ocular tension. Care was taken never to fill the anterior chamber completely with blood, but to leave some space for the formation of aqueous humor. Recent observations seem to suggest that better results are obtained if the blood remains in the anterior chamber for longer periods.

K. L. STOLL.

THE EFFECTS OF PARACENTESIS ON THE COURSE OF NONINFECTIOUS KERATITIS. T. SANO, Acta Jap. Ophth. Soc. **36:** 144 (Nov.) 1932.

The keratitis was produced by the injection of 0.2 per cent solution of mercuric chloride into the cornea. The following conclusions were made: 1. Puncture of the anterior chamber has a definite influence on the recovery of keratitis produced by the injection of mercuric chloride. 2. The results of therapy for hypotony of the eye do not depend on the degree of the hypotony, but on the degree of the increase in the metabolism of the anterior parts of the eye.

A. KNAPP.

Society Transactions

EDITED BY DR. JOHN HERBERT WAITE

NEW YORK ACADEMY OF MEDICINE, SECTION OF OPHTHALMOLOGY

ALGERNON B. REESE, M.D., *Secretary*

Feb. 20, 1933

MARK J. SCHOENBERG, M.D., *Chairman*

CHANCRE OF THE EYELID YIELDING SPIROCHAETA PALLIDA. DR. SAMUEL P. OAST.

The patient presented a flat plaquelike growth, the color of putty, with superficial ulceration; it involved part of the skin of both eyelids and the bridge of the nose, with extension to the bulbar conjunctiva. The nature of the lesion was not clear until treponemas were demonstrated in the scrapings. Later a 4 plus Wassermann reaction was reported.

THE KEELER DECAGON OPHTHALMOSCOPE AS A REFRACTOMETER. DR. CONRAD BERENS and DR. CHARLES K. MCLAUGHLIN.

The Keeler decagon ophthalmoscope was studied for the purpose of determining its value in simplifying refraction. A comparison was made of the error of refraction as estimated by means of the refractometer unit, retinoscopy and the cycloplegic and postcycloplegic acceptance. The following conclusions in regard to the refractometer unit were drawn: In simple hyperopia and myopia the error of refraction can usually be determined within from 0.5 to 1 diopter, in many instances within 0.25 diopter. In astigmatism greater than 1.5 diopters, the axis can usually be determined within 15 degrees, and the strength of the cylinder, within from 0.5 to 1 diopter.

RETINAL DETACHMENT CURED BY ELECTROCOAGULATION. DR. ARNOLD KNAPP.

This article will appear in full in a later issue of the ARCHIVES.

NEPHROSIS WITH EMBOLISM OF THE CEREBRAL, BRACHIAL, CENTRAL RETINAL AND CILIARY ARTERIES. DR. DAVID WEXLER.

This article will be published in full in a later issue of the ARCHIVES.

OCULAR FINDINGS IN A SERIES OF INTRACRANIAL MENINGIOMAS. DR. T. B. HOLLOWAY.

The cases referred to were from the neurosurgical service of Dr. Charles H. Frazier at the University Hospital. After referring to the probable origin of these tumors and to certain of their characteristics,

Dr. Holloway stated that the average age of the patients was 37½ years. The group was made up of twenty-one growths involving the frontal lobe, nineteen of the temporal lobe, six of the parietal lobe and nine of the occipital lobe. Reference was made to the frequency with which headaches and impaired vision are the initial symptoms in cases of intracranial tumors. Eight of the patients had exophthalmos, and eight, nystagmus. It was impossible to determine the vision of twenty patients; in ten patients it was 6/12 or better; in five it was better than 6/12 in one eye and worse than 6/12 in the other; in eight, it was between 6/12 and 6/60, and in the remaining twelve, it was reduced to counting fingers or less. Thirty-eight of the patients had papilledema; seven, postpapillitic atrophy; one, primary atrophy, and nine, no changes in the disks. As to the fields, concentric contraction was present in twelve instances, right homonymous hemianopia in ten, and left homonymous hemianopia in three; the fields were grouped in six instances as miscellaneous. For various reasons it was impossible to obtain accurate fields for seventeen patients; ten patients had normal fields. The ocular signs and symptoms pertaining to the various lobes were discussed separately.

DISCUSSION

DR. BYRON STOOKEY: Dr. Holloway spoke of the meningiomas arising in the frontal, temporal, parietal and occipital lobes, and mentioned the initial symptoms of headache and loss of vision. Headache and loss of vision are symptoms of increased intracranial pressure and can occur in association with meningiomas, no matter where they lie. A meningioma, furthermore, is a type of tumor which replaces brain tissue as it grows, and for that reason a relatively low grade of papilledema is frequently found when the tumor is extremely large. In fact, when a patient presents neurologic signs of a tumor of the brain and no papilledema, I am apt, from a preoperative standpoint, to consider that he has a meningioma, even though there may be no other signs indicative of this condition. This replacement of brain tissue is in contrast to the growth of the gliomas, in which the brain tissue is expanding and increasing, and therefore high pressure and early papilledema are present. Meningiomas vary in consistency. They may be extremely hard, in fact, even bony. I have at the present time a patient with a large meningioma about the size of a golf ball lying on the olfactory groove; the tumor is calcified and visible in the x-ray plate, yet the man has had no disturbance of the olfactory nerve and no visual disturbance—nothing to indicate the presence of a tumor.

I have always found that the Foster-Kennedy syndrome of atrophy of the optic nerve on one side and papilledema on the other is invariably associated with a tumor of the frontal region, and not of the middle fossa.

Dr. Holloway also referred to the fact that meningiomas are likely to arise from the clusters of cells that are around the various cranial nerves, and that they have also a frequent association with the great venous channels, since these clusters invade the channels. When they do arise from the base of the skull, they may include and surround the optic nerve. In that event, naturally one expects optic atrophy as the first symptom, and it is in this group of cases that exophthalmos mani-

fests itself. Exophthalmos arises because of the production of bone around the orbit and the increased pressure that takes place.

The tumors of the temporal and of the occipital lobe are, I think, of special interest in this group, since tumors in this region give rise to defects in the visual fields. The visual fibers, as was pointed out by Meyer, and as was shown by the works of Cushing and Pappenheim, retain a characteristic position, and one can predict from the position of the defect in the field whether the tumor is high or low in the occipital or parietal region. One cannot rely on the sign of a quadrantic defect alone. I should like to ask Dr. Holloway how he takes visual fields, because I am sure that by my method I could never detect quadrantic defects unless I used the large screen.

I do not think that one can rely on a particular defect in the visual field for the complete localization of a tumor. Other neurologic signs accompany these tumors, namely, the more definitely formed visual hallucinations which occur in the temporal lobe and the visual hallucinations of the cruder type of exploding lights which occur in the occipital lobe.

Dr. Algernon B. Reese: Dr. Holloway said that he would take any one's suggestion in regard to the interpretation of a certain field that he showed so I want to venture an explanation. In this case there was merely an enlargement of the blind spot in both eyes. When papilledema is marked, the disk is pushed out toward the vitreous sufficiently to pull the retina with it in the region directly adjacent to it. In other words, there can be a peripapillary detachment of the retina, and I think that that occurs sometimes when the papilledema is of sufficient degree.

Dr. Isadore Goldstein: Dr. Holloway referred to the tests for the sense of smell in tumors of the frontal lobe. Dr. Wexler and I have studied the olfactory bulb in normal persons and in those with tumors of the frontal lobe. The findings, however, have been negative, and the investigations are being continued. We believe, as Dr. Holloway does, that because of the changes in the optic and acoustic nerves, there must be some pathologic condition in the olfactory bulb. Dr. Holloway mentioned that he has a method of testing the sense of smell. If it is for publication, I should like to know it.

Dr. T. B. Holloway: All our fields are taken by my associate, Dr. Wentworth, who has outstanding ability in perimetry. They are all taken with the Ferree-Rand perimeter, under exactly the same conditions of illumination and surroundings. We use a test object that is placed 1° or 2° in the white field, and one that is placed 0.25°, 0.5° or 1° in the red field. Except in unusual cases, we do not use a screen in cases of tumor of the brain, because we believe that we get better fixation on a Ferree-Rand perimeter than we do on a tangent screen. Further, this avoids various adjustments of the patient. Second, we believe that we get just as good, if not more accurate, results by using a red test object than we do by a small white test object on a black or the average gray background.

Concerning the frequency of the Gowers-Paton-Kennedy sign seen in certain instances, I realize that it is tumors of the frontal lobe which have previously given rise to this sign, but unfortunately in this series we did not have a single instance of this. This series just touched on

an "anatomic pet," such as every one has, and therefore I was delighted when I found a tumor of the temporal lobe that produced the sign.

I have two fields that show definite quadrantic defects, but I also showed two others, taken in cases of tumors of the temporal lobe in which there was an exaggerated crescentic defect; I pointed out, however, that in each of these two fields the tendency for the greater cut was in the superior quadrant. As to the importance of the localization of a growth by means of the visual fields, all ophthalmologists realize that without the associated neurologic signs it is impossible to state where the lesion may be. Curiously enough, the last field shown on the screen was that of a patient whose only neurologic symptom was a sensory aphasia until a right homonymous hemianopia was elicited in my office. It must be remembered that a homonymous defect in the superior quadrant may also be produced by a pituitary adenoma.

In regard to Dr. Reese's question, I had not thought of the possibility of detachment of the retina, as he suggested. Detachment may have occurred. I had in mind vascular changes.

In regard to Dr. Goldstein's question about olfactory tests, we are not using any new method. We are making these tests in cases of retrobulbar neuritis simply to get as much information as we can concerning this condition, for there is still a great deal to be learned about its etiology.

THE EYE IN SCULPTURE AND PAINTING. DR. PERCY FRIDENBERG.

I have chosen the classical plastic age as a starting point because there have been a continuous history and tradition since that time. The art of other periods (Egyptian, Assyrian) came to an end, but classical art continued and evolved. The representation of the eye in art is one of the distinguishing features of ages, schools and individuals. Primitive people, like children, unable to cope with difficulties of form, took refuge in spatial and numerical exaggerations, or in realistic imitation. For example, Siva, the destroyer, is depicted with a dozen waving arms to show superhuman power; Maya (Ceres), with many breasts to show the bounty of nature. They introduced thin plates of metal, glass, marble or painted wood between the eyelids, which were made thick and protruding to facilitate this inlay. The pupil or corneal reflex was often represented by a bit of amber or semiprecious stone. Postarchaic heads were brightly colored, and the iris and pupil were often represented by a disk of brown or blue, generally with a reenforcing line for the limbus and the pupillary margin. Early sculpture, largely of divinities, gave them a superhuman share of energy, ferocity and power. The heads of animals were common, and at a later stage the eye of the eagle, the bull and the lion was traditionally preserved, at first for divinities and rulers, later for warriors and finally as typical for all males. This eye was large, glaring, prominent and highly curved, with the palpebral fissure almost circular.

In drawings on early vases from Crete, one finds the male eye represented by a circle with a little terminal triangle, or dash, at both the inner and the outer canthus. A female type had appeared earlier with a long, narrow palpebral fissure, a flatter globe and prolongation of the brow and the external canthus, the former toward and down the nose,

the latter out to and far beyond the outer orbital margin, in fact nearly to the ear. The narrow palpebral fissure of females allowed less of the sclera to appear than in the male eye and made it appear flatter. The female eye was always more almond-shaped, to suggest gentle, soft femininity. The prolongation of the palpebral fissure and of the eyebrow may have been a registration of cosmetic procedures common among the fair sex then as now. Lifting of the inner part of the lower lid was considered especially sensuous and beautiful. This produced the spiral or tendril palpebral fissure which is noticeable particularly in representations of the head of Venus.

With progress toward an ideal of proportion and moderation, only monsters retained the animal eye and, strikingly, many of them also the animal body or part of it. Satyrs and centaurs had the primal "Glotz" eye and other somatic features (irregular growth of the beard and hair, coarse formation of the lips and nose, and obesity), which tended to accentuate their barbaric nature.

The archaic stage showed its Asiatic origin in the persistence, possibly because of reverence of tradition, of the prominent eye with little or no modeling of the soft tissues, lids or orbit. All was smooth and on a single curved surface. A realistic gaze was produced by marking the cornea with a circle and the pupil with a dot. These eyes suggested an eye immobilized with an anesthetizing fluid, which filled up all inequalities of surface, smoothed out the wrinkles and gave the look of a jelly cast with unwinking lids and an immobile globe. This gave to early heads of Apollo and Diana a peculiarly vapid and goggling look.

The classical period showed modeling of the margins of the lids, of the lids themselves and of the surrounding planes. The eye was in a realistic orbit, but the globe was smooth and unworked. The use of color was given up more or less. The sculptors found that light and shade were valuable allies. The eye became deeper set, although never enophthalmic. The globe, suavely modeled, showed a tendency to flatness in the female and to sphericity in the male. As the brows and lids were modeled, expression was brought into the features of the upper part of the face and to globes without pupils or irides. Shadows must have given an impression of these structures, especially when the figures were placed on high, for the faces did not lose majesty or sweetness. This sacrifice of emotion for the sake of greater balance was significant of the evolution of artistic feeling hand in hand with religious ideals.

The Hellenic esthetic age was essentially biologic. Beauty, to these artists, was form indicative of perfect function. In this conception, balance was implicit, as was also proportion. The same sense led them to eschew the representation of extreme emotion and of violent action, but to show readiness for any form of action or feeling. Their moderation was not ascetic; it meant an equal and harmonious expression of life and not a denial of any of its manifestations or urges. Violent emotion or passion, which are fleeting and changeable, were not, in their opinion, suited to perpetuation in unchanging marble.

With the decline of classical culture, a new period entered. The early Christian art showed a naive imitation of the Hellenic form of the eye and of Asiatic tradition, and the Byzantine stage, a return to the archaic representation of the eye. Soon another factor appeared, namely, the suggestion of deep emotion. Asceticism and the cultivation

of the Christian virtues of humility, charity, hope and faith called for expression. These were embodied above all in the features of Christ and of the madonna. Religious feeling, adoration, pity and resignation were to be shown, and soon it was realized that these are shown above all by the gaze. Later, not only the holy family and the saints but princes and scholars were depicted. Portraiture came into its own, especially in the protestant countries in the north of Europe. The forgotten man, the boor, the artisan and the beggar were now subjects for art. The indication of emotion was carried by the attitude of the eye and by the suggestion of expressive motion of the eye. Dutch, French and later English art showed this beautifully, although it was not lacking on the canvases of the Italian, and, above all, of the Spanish, masters.

ALGERNON B. REESE, M.D., *Secretary*

March 20, 1933

MARK J. SCHOENBERG, M.D., *Chairman*

ANGIOID STREAKS OF THE RETINA WITH PSEUDOXANTHOMA ELASTICUM. DR. DAVID A. NEWMAN.

Angioid streaks of the retina are characterized by the formation of striae, exudates and hemorrhages. The striae are jagged, dark gray, of about the caliber of a medium-sized retinal vessel and situated deeply in the retina or in the superficial layers of the choroid. They radiate from an incomplete band surrounding the disk and are accompanied on either side by an atrophic choroid. The exudates and hemorrhages are usually found between the disk and the macula, and in absorbing they leave behind poorly pigmented, atrophic areas.

Recent observations have associated this condition with a rare disease of the skin, pseudoxanthoma elasticum. Grossly, the pathologic condition of the skin manifests itself as a slowly progressive degeneration of the elastic tissue, producing a loss of tonus and friability of the skin, with small orange-colored tumefactions, best noted in the axilla, the neck, the cubital fossae and the popliteal spaces. Microscopically, there are a chemical change, in which the connective tissue takes on a basophilic stain instead of the usual acidophilic stain, and a physical change, in which there are thickening and disintegration of the fibers.

DISCUSSION

DR. MILTON L. BERLINER: In this connection, I should like to report a case of angioid streaks that occurred in a woman, aged 70, who was being treated for Paget's disease. I believe that another case of angioid streaks in association with Paget's disease was reported last spring in Boston. In both these cases there was no evidence of pseudoxanthoma. After seeing this case, I examined the fundi in twenty-eight other cases of Paget's disease and did not find any that showed angioid streaks in the retina. However, in three of these cases there was marked sclerosis of the choroidal vessels.

GLASSY NETWORK IN THE ANTERIOR CHAMBER: REPORT OF A CASE. DR. JOSEPH ZIPORKES.

This article was published in full in the October, 1933, issue of the ARCHIVES, page 517.

IRIDODIALYSIS WITH HYPERTENSION: SURGICAL REATTACHMENT. DR. BEN WITT KEY.

A man, aged 55, came for consultation on March 25, 1932. He had been struck in the right eye by a small stone six months previously. He complained of constant "dazzling" sensations and confusion of objects; reading was difficult, especially on the right side of the page. The eye was quiet; the cornea and the anterior chamber were normal; the nasal fourth of the iris had been torn from its basal attachment; the lens was clear, and the tension of the globe measured from 43 to 60 mm. of mercury (Schiötz). The fundus was normal.

Operation, according to the method suggested before the section in November, 1931, was performed on March 29, 1932, it being kept in mind that later trephining would be necessary to control the hypertension. Lantern slides in illustration of the eye before and after the operation were shown. The slides made one year after the operation showed the level of the iris to be normal, and without folds. The pupil was almost perfectly round; it was active to light and equal in size to that of the left pupil. There was no prolapse of the iris, nor was there visible the slightest "chink" of dialysis, so closely was the section of the iris replaced. At the limbus could be noted a small hole in the lip of the sclera where the suture was placed. Of some importance is the fact that the tension of the eye had remained normal, from 22 to 27 mm. of mercury, since the operation, and trephination had thus far been unnecessary. This condition had been maintained for one year at the time of presentation. The vision of the eye, with correction, was 20/15.

DISCUSSION

DR. MARTIN COHEN: What was the tonometric reading for this eye before operation was performed, and how does Dr. Key explain the hypertension? Was it due to vitreous fibers blocking the angle, followed by the closure of the peripheral angle and finally by the absorption of the vitreous fibers?

DR. LEWIS W. CRIGLER: I have seen a great many cases of iridodialysis, and have never seen any serious ill effects from this condition. There is a question in my mind as to whether the anticipated results justify the operative risk.

DR. BERNARD SAMUELS: The effort to replace the dialyzed sector of the iris succeeds only when the root of the iris is inserted into the wound in the sclera at a considerable distance from the anterior surface of the ciliary body. If hypertension develops after the replacement of the root of the iris to the angle of the anterior chamber, it is in all probability due to an ever-increasing anterior peripheral synechia starting from the place of attachment. It is certainly unusual that hypertension should be present in ordinary traumatic iridodialysis; one would expect the opposite effect. The angle of the anterior chamber in irido-

dialysis is supposed to be opened. However, a blow capable of causing iridodialysis usually does considerable damage to tissues other than the iris.

DR. ALGERNON B. REESE: In thinking over the possible cause of glaucoma in this case, it is interesting to recall that in cases of congenital aniridia, one not infrequently encounters glaucoma. This case may be a substantiation of the contention of some ophthalmologists that there is absorption of aqueous through the iris.

DR. BEN WITT KEY: In reply to Dr. Cohen, I gave the tension of the eye as from 45 to 60 mm. of mercury (Schiötz) before operation and from 22 to 26 mm. after operation. I stated that I had no explanation for the relief of the hypertension following the operation and that I had intended to do a trephination if necessary. The tension, however, has remained normal for a year.

Dr. Crigler's suggestion represents a natural reaction of one who has not performed the operation. In a paper presented before this section in November, 1931, I anticipated some discussion challenging the risk of operative replacement of the detached iris and presented a consideration of this subject (Extensive Iridodialysis; Operation, Reattachment, ARCH. OPHTH. **7:** 748 [May] 1932). Some of these cases do not present any symptoms; this is true of a case which Dr. Doherty has seen with me recently. The patient is a boy, 10 years of age, who has a dialysis of about one fourth of the basal attachment of the iris, the midpoint of which is in a vertical line through the tangent at the upper limbus; there is no exposure, and therefore there are no symptoms, and one would not be justified in suggesting operation.

CALCIFIED HYALINE DEPOSITS (DRUSEN) ON THE OPTIC DISK, ASSOCIATED WITH PIGMENTARY CHANGES IN THE RETINA. DR. ISADORE GIVNER.

This article will be published in full in a later issue of the ARCHIVES.

SYMBLEPHARON AND OBLITERATED CULDESAC CORRECTED BY A BUCCAL MUCOUS MEMBRANE GRAFT. DR. DANIEL KIRBY.

H. F. N., a white youth, aged 17, was struck in the left eye eight years prior to presentation by a piece of plaster thrown from a stick. He was treated by a neighbor, who washed the eye with milk, and then by the family physician, who used ether anesthesia and cleaned out the débris. Four months after the original injury a graft of skin was taken from the left thigh and put into the left eye. At the time of presentation, vision in the right eye was 20/20+; in the left eye it was limited to the perception of movements of the hands. Vision was not improved by glasses.

The left eye showed slight entropion of the upper lid and marked entropion of the lower lid, with distortion of the margins of the lids. A thick band of scar tissue produced symblepharon between the left lower lid and the globe. The inferior culdesac was obliterated. The inferior bulbar conjunctiva was replaced by the graft of white skin taken from the thigh. Deep bands of contraction ran to the lateral sulci. A narrow, canalized symblepharon extended from the inner canthus of the upper lid to the globe.

The operation to correct the defect was undertaken on April 26, 1932. It consisted of an incision through the tissue which joined the left lower lid and the globe, then a dissection and removal of the bands of scar tissue, the dissection being continued to form a new inferior culdesac. Then a graft was fashioned from the buccal mucous membrane of the lower lip, in the extension produced by the eversion of the lip. The graft appeared about 25 by 45 mm., but when freed and removed it contracted to about 15 by 35 mm. The submucosa was in great part removed by scissors, and the graft was transplanted to the new culdesac which had been prepared. Sutures were used to join the edges of the graft to the edges of the culdesac, on the side of the lid as well as on that of the globe. Then three double-armed silk sutures were passed through the central area of the graft, drawing this down into the culdesac; the needles were passed through the skin approximately at the orbital margin and the sutures drawn out to be tied over a rubber plate on the cheek. The lids were closed by temporary sutures, and a pressure dressing was applied. The sutures were removed in seven days. A prosthesis of thin glass shell was fitted nineteen days after the operation. A year after the operation the patient presented a good lower culdesac in the eye operated on, good motility of the globe and ability to wear a prosthesis.

DISCUSSION

DR. JOHN J. REED, JR.: If the transplanted mucosa has been grafted without thinning the tissue by excising most of the submucosa, the graft retains its identity for many years. I have found in some cases that after three years the original graft has become blended with the surrounding tissues, making it difficult on inspection to locate the line of demarcation. I have used the buccal mucosa for replacing conjunctiva which has been destroyed by acid burns with the resulting formation of scar tissue and cicatricial bands.

FIVE CASES OF GLASS IN THE EYEBALL: THE VOGT METHOD OF LOCALIZATION. DR. HARRY A. GOALWIN.

This method of searching an eye for glass was invented by Vogt, of Zurich, in 1920, and was described by him in connection with his courses on the use of the slit lamp given at Basel and Zurich during the years from 1922 to 1924. Haemmerli, of Vogt's clinic, again described the method in May, 1926. He reported twelve cases, in six of which the usual roentgen examination failed to disclose the presence of a foreign body. By the use of the special technic in these six cases, metal was disclosed in three, glass in two, and the point of a lead pencil in one.

In 1927, Dr. Goalwin visited Vogt's clinic and learned the technic, which he has since modified slightly. Briefly, this method consists of the use of a specially shaped, small x-ray film introduced into the anesthetized conjunctival sac. A routine examination consists of ten exposures, five of which are lateral (temporonasal) views, and five, views from above downward. The direction of the gaze is changed five times in each of the two sets, namely: exposures 1 and 6, straight forward; 2 and 7, nasally; 3 and 8, temporally; 4 and 9, upward, and 5 and 10, downward.

Dr. Goalwin then showed films which identified glass foreign bodies in five patients; four films showed glass in the anterior segment of the eyeball, and one, in the upper eyelid.

IRIDODIALYSIS REPAIRED BY SUTURING. DR. EDWARD N. DEWITT.

A 4 year old child was thrown from a frightened horse, the accident resulting in many minor injuries. The left eye had a deep abrasion of the cornea at about 2:30 o'clock, involving the limbus, together with iridodialysis of about one third of its circumference and a vertical tear through the stroma of the iris. Under general anesthesia, an incision was made in the cornea in the abraded area, and through this incision one lip of the vertical tear was grasped with iris forceps and then a suture was placed in the extreme end, uniting it to the stump of the iris. A second suture was placed in the opposite lip of the vertical tear and united it to the stump, so that both lips of the torn iris and the stump were thus united. A binocular dressing was applied and was not removed until the third day. On the seventh day the sutures were removed, and the iris remained in place. A photograph taken two weeks later showed the iris in place. There was normal reaction to light and distance, and vision of 20/20.

DISCUSSION

DR. BEN WITT KEY: I think that this case shows the value of the suture in this operation. In performing three operations on one patient Goldfeder used simple incarceration by means of an iris hook. I believe that this is an uncertain procedure.

ALGERNON B. REESE, M.D., *Secretary*

April 17, 1933

MARK J. SCHOENBERG, M.D., *Chairman*

RETINITIS PIGMENTOSA WITHOUT PIGMENT. DR. OLGA SITCHEVSKA.

This patient, who was seen at the Light House Clinic, presented classic symptoms of retinitis pigmentosa: hemeralopia, contraction of the visual fields to from 5 to 10 degrees, yellow atrophy of the optic nerve, attenuation of the retinal blood vessels and posterior polar cataracts, but no proliferation of pigment into the retina of either eye.

Vasodilators, amyl nitrite and glyceryl trinitrate were used with transitory benefit.

IRIDIC PROCESSES. DR. ALGERNON B. REESE.

One or several of the ciliary processes, instead of arising from the normal site on the corona ciliaris, may arise from the posterior surface of the iris. When this occurs the dilator muscle layer of the iris is interrupted at the base of the process. Also, such processes are covered by two layers of pigmented epithelium, instead of by a layer of non-pigmented epithelium and a layer of pigmented epithelium, as is the

case in ciliary processes. Specimens illustrating these points were shown, and the embryology of this congenital anomaly was traced in embryos.

DISCUSSION

DR. BERNARD SAMUELS: There is no sharp line of demarcation between the ciliary body and the iris. The iris is simply a prolongation of the vascular layer of the ciliary body. Many of the ciliary processes go far over onto the posterior surface of the iris. Some of the sections shown here demonstrate ciliary processes that happen to extend far over onto the undersurface of the iris. One has no right to call these iridic processes. They are processes of the ciliary body that extend far over onto the root of the iris.

DR. DAVID WEXLER: It is interesting to note that the iridic processes shown by Dr. Reese take the same stain as the adjacent ciliary processes. In one specimen among my material I found a process common to both the ciliary body and the iris and merging into the iris stroma in much the same way that Dr. Reese has described. This was a pathologic specimen in which the choroid and ciliary body were heavily infiltrated with epithelioid cells. The process mentioned, in common with the other ciliary processes, was similarly affected.

DR. ISIDOR GOLDSTEIN: From the study of the iridic processes described by Dr. Reese, it was my impression that the tissue belongs to the ciliary body. It is true, however, that the ciliary body and iris are connected by this bridge of tissue.

DR. ALGERNON B. REESE: Most of the specimens that I have shown have been studied in serial sections. Whether the section shown here happens to go through the pupillary area or not makes no difference. If a ciliary process does not arise from the posterior surface of the iris, there is no possible way that it can be made to appear to do this by the angle at which it is sectioned. Certainly there can be no doubt in those cases in which the process was far enough over on the iris to interrupt the dilator muscle layer. Furthermore, a process on the iris has two pigmented epithelial layers instead of one layer of nonpigmented epithelium and one layer of pigmented epithelium as the ciliary processes have. Dr. Verhoeff has seen some of these sections, and no question arose in his mind as to their position on the iris. Whether these processes should be called iridic processes or whether some other term should be used is of no particular importance. The significant point is that processes which normally arise from the corona ciliaris and are termed ciliary processes sometimes arise from the posterior surface of the iris.

EMBRYOLOGY AND PHYSIOLOGY OF PIGMENT FORMATION. DR. SAMUEL PECK.

The formation of pigment in the melanoblasts of ectodermal and mesodermal origin is due to the oxidation of a colorless precursor of pigment by an enzyme. It has been shown fairly definitely that dioxyphenylalanine is the probable precursor of pigment. This has been demonstrated by the work of Bloch. I have been able to show, as a further support for this theory, that the melanoblasts react only with the levorotatory β-3-4 dioxyphenylalanine and cannot be elicited with tyrosine, epinephrine or other related derivatives of dioxyphenyl.

If one transfers to the eye what one has learned about the formation of pigment in the skin, a number of interesting facts become clear. The physiology and embryology of pigment formation in the eye have been studied by Miescher. The eye has two layers of pigment, an ectodermal and a mesodermal layer. The ectodermal cells are found in the retina, and the mesodermal cells in the choroid, corpus ciliaris and iris. The formation of pigment in the eye differs in one important way from that in the skin; that is, active formation of pigment goes on only during embryonal life and a short time afterward, and then becomes quiescent. This is seen from the dioxyphenylalanine reaction which is positive only during this period. In studying the formation of pigment one finds that the mesodermal and ectodermal pigment is formed at different times. This is a further proof of their independent origin. It is analogous to what I have said about the formation of ectodermal and mesodermal pigment in the skin. In the chick the dioxyphenylalanine reaction becomes positive with the beginning of pigment formation in the pigment cells of the pecten on the eleventh day of incubation, and in the pigment cells of the choroid about the fifth day. The reaction becomes more intense with the increasing formation of pigment and lasts for a short while after birth.

In my own study of the embryology of pigment formation in the rabbit eye, I noticed that pigment was first found in the eye before melanin was observed in any other place in the body. It was first seen in 15 mm. embryos. In sections of 62 mm. embryos the dioxyphenylalanine reaction was still positive. Neither Miescher nor I have obtained positive dioxyphenylalanine reactions in the normal adult pigment cells of the eye.

One important fact must be added about pigmented tumors. When a pigmented tumor develops in the eye, whether it is carcinoma or sarcoma, the dioxyphenylalanine reaction becomes positive again for reasons not yet evident. On the basis of the physiology and embryology of pigment formation, pigmented tumors can be classified as follows:

	Origin
Melanocarcinoma	Skin: epidermis, hair follicle apparatus Eye: pigmented cells of the retina Mucous membranes: epithelium of the mouth and nose; conjunctiva Ectodermal pigment cells of the nervous system
Melanosarcoma	Skin: cutis, from the cells of the mongolian spot and blue nevus Eye: choroid, corpus ciliaris and iris Mesodermal pigment cells of the nervous system
Nevocarcinoma	Controversy about the origin of the nevus cells not yet settled; since both the cells of both nevus and nevocarcinoma often give a positive dioxyphenylalanine reaction, they are melanoblasts
Bloch's benign pigmented epithelium (two main types)	(a) Mainly composed of cells of basal type (b) Much rarer; composed mainly of cells of dendritic type

PATHOLOGY OF THE PIGMENTED LESIONS IN THE FUNDUS. DR. DAVID WEXLER.

The choroid, being a vascular structure, has considerable power of restitution following moderate inflammatory lesions. The retina is not so fortunate in this regard. Minimal lesions in the choroid often "break through" into the retina, and seriously affect this layer far out of proportion to the extent of the choroidal disease. This phenomenon depends on two important factors: first, the vulnerability of the "critical zone" of the choroid, its most anterior layers, and, second, the decided proliferative tendency of the pigmented epithelial cells. Other events leading to the destruction of the retina are the liberation and migration of pigment granules and the increase of phagocytic glia cells about the blood vessels. This increase of cellular activity in the retina in response to pigment artificially introduced has been noted by Friedenwald and Chan and by Berliner. This was illustrated in a case of retinitis pigmentosa shown in the demonstration. In the adventitia of one of the retinal blood vessels were numerous large polyhedral cells containing pigment granules. Apparently this is the method of disposition of the migrating pigment.

Another interesting specimen shown was the eye of a patient, 2 days old, with icterus neonatorum. The choroidal blood vessels were swollen with large masses of pigment, while the choroid itself and the retina appeared intact. The pigment in this case was no doubt derived from the breaking down of pigment cells throughout the uvea, possibly owing to the toxic effect of the circulating bile.

PIGMENTATION OF THE FUNDUS. DR. ARTHUR J. BEDELL.

Congenital grouped pigmentation of the retina is found in comparatively few cases and consists of small or large rounded, dark brown spots which lie beneath the retinal vessels and sometimes even below the superficial choroidal channels. There may be only a single spot, although more commonly there are several collections of fine isolated specks as well as flat plaques more than a disk diameter in size. The special points of diagnosis are the sector grouping, with the smaller spots near the disk, the rounded edge, the stationary character and the location deep in the retina or even in the choroid. The condition does not cause any impairment of vision.

The pigmentation of the fundus which follows injury is different from any other form, although a superficial examination may confuse the observer or even lead him into error. After a severe, nonpenetrating wound of the globe there may be many retinal hemorrhages and widespread retinal edema. When the hemorrhages are absorbed and the edema subsides, there is a change in the pigmentation of the involved area. This is characterized by regions of absorption and deposit of pigment. In some cases there is a marked decrease in the pigment, resulting in a pale background over which rounded, black areas are distributed. After traumatic rupture of the choroid, the edges of the tear become pigmented and are easily distinguished from the white scleral scar.

The prolonged, severe retinal changes which occur in patients with hypertension and with some forms of nephritis show distinctive, round,

sharply delimited, chocolate brown spots which vary in size and are seldom confluent. These are usually present only in the terminal stages of hypertension and are widely distributed, not only about some of the major blood vessels in the periphery of the fundus but also near the macular region. They are almost invariably surrounded by a pale, narrow ring, which is never as wide as that found in a frank choroiditis. Furthermore, they are always so associated with marked sclerosis of the retinal vessels as to produce a pathognomonic picture of the conditions in which they occur.

It is probable that the greatest amount of confusion is caused by the somewhat similar appearance of the fundus of syphilitic chorioretinitis and that of retinitis pigmentosa. This is more bewildering when the observer uses the Wassermann test as the sole basis for his opinion. It seems superfluous to state that a patient may have a true retinitis pigmentosa and also have syphilis. The combination calls for discriminating analysis.

In syphilitic chorioretinitis which simulates retinitis pigmentosa one often finds areas in which the choroid is bleached and the pigment from the pale areas is deposited around the periphery of the lesions. When the migrant pigment is in apposition with the blood vessels it actually forms an invaginating black tube of varying thickness and length. Under some conditions the pigment is arranged in a stellate form, but careful inspection will reveal a real difference between this and the typical deposits of retinitis pigmentosa. The syphilitic patients in whom one verifies these technical points must be examined carefully, for as the process advances the choroid seems to disappear, the retinal vessels become markedly attenuated and the pigment is finally dissolved. Before this stage is reached it is not uncommon to see large, massive, pigmented deposits which gradually fade until lost. As the process of solution may be interrupted at any time, or may progress spasmodically, bizarre pictures are found.

The fundus picture in typical retinitis pigmentosa varies considerably with the age of the patient. In early life scattered, thin deposits are found in a zone several disk diameters from the posterior pole. As the disease progresses over a long term of years—this period, however, is not uniform—the band of pigment widens, extends both peripherally and centrally and usually becomes so much denser that not infrequently it is possible actually to see beneath the pigment sheet. The blood vessels become decidedly narrower, many of the small branches are occluded, and the entire fundus, including the nerve head, loses its normal color to become a pale, dirty gray. There are so many variations in retinitis pigmentosa that one is confused by terms, such as retinitis punctata albescens, retinitis pigmentosa sine pigmentum and choroideremia, which in all probability represent phases of the same underlying basic disease. A study of all cases of retinitis pigmentosa discloses lacelike pigmentation. A similar inspection of retinitis pigmentosa sine pigmentum always reveals pigmentation, which is often in fragments without regular arrangement. This also seems to be true of choroideremia, for all the reported cases and the two which I have seen showed massed pigment. It seems probable that retinitis punctata

albescens is only a phase, an indefinite stage or a modified picture of retinitis pigmentosa; at least this seems to be suggested by the photographs and analysis in the cases reported.

DISCUSSION OF PAPERS BY DR. WEXLER AND DR. BEDELL

DR. BERNARD SAMUELS: One thread ran through the whole discourse, namely, that all pathologic pigment is derived from the pigmented epithelium. I was particularly interested in Dr. Bedell's statement that the color is sometimes dark brown or reddish and sometimes jet black. When the pigment is dark brown or reddish there has been little proliferation of epithelium; when it is jet black, there must be several layers superimposed. Dr. Bedell demonstrated that the pigment in the macular region is always jet black. The pigmented cells in that locality are normally taller and more densely packed with pigment granules than they are elsewhere, so that when they proliferate, they preserve these characteristics. Dr. Bedell showed that the black plaques in the fundus sometimes become white in the center, whereas at the periphery they remain black. That brings out the old rule in pathologic conditions of the eye that the pigmented epithelium is almost indestructible. If it disappears in one place, it crops out in another.

DR. MILTON L. BERLINER: I think that the statements of Dr. Wexler are interesting, particularly in regard to the pigmented epithelium. In experimental animals (rabbits), injury of the epithelium by means of needles or substances strongly poisonous to the retina, like phosphorus, produces a proliferation of the pigmented epithelium cells. These new young cells are elongated, and have a tendency to advance into the retina itself. They go through the mesh of external limiting membrane, and get as far as the nuclear layer where they seem to drop their pigment. The histiocytes pick up the pigment granules, and carry them back again to the perivascular tissue spaces. Friedenwald and Chan showed that the Müller fibers have a phagocytic action. Using particulate matter (india ink) I was unable to verify this. I believe that the Müller fibers are derivatives of the so-called astroglia, the supporting glia, and that the phagocytic type of glia, as shown by Rio Hortega, is the microglia. In the adult human retina, by specific silver impregnations, I found only small numbers of microglia; these were situated in the nerve fiber layer.

THE SIGNIFICANCE OF BLOOD CHOLESTEROL IN THE DIETARY MANAGEMENT OF DIABETES, WITH SPECIAL REFERENCE TO OCULAR COMPLICATION. DR. HENRY GEYELIN.

The purpose of this presentation is to review the results obtained during the past ten years in about 500 diabetic patients. They were treated with insulin and a normal diet, with particular emphasis on the relationship of this treatment to improvement or lack of improvement in the ophthalmologic conditions that are so commonly associated with diabetes. Among these conditions one may enumerate the various forms of retinitis, iritis and cataract.

It is, I think, generally accepted that the normal diet throughout the civilized world is one in which approximately from 55 to 70 per cent of the total number of calories is derived from carbohydrates, from 10

to 20 per cent from protein and the remainder from fat. In terms of grams of these substances the normal diet is one in which the ratio is approximately 4 : 1 : 1, that is, 4 Gm. of carbohydrate to 1 Gm. of protein and 1 Gm. of fat. During the last ten years 90 per cent of a group of 916 patients with diabetes were treated with a normal diet, appropriately determined for age, size and sex, and with insulin. It is not the purpose of this communication to detail the advantages of such treatment as compared with the use of other diets in diabetes, but rather to emphasize what I believe to be the advantages of the normal diet in the prevention and control of the various ophthalmologic conditions which occur during the late decades of life in many diabetic patients.

It is unfortunate that I have not at my disposal any accurate data which will justify the drawing of definite conclusions, but it has been my impression that the incidence of vascular changes in the retinas of diabetic patients has been much decreased since this type of normal diet has been used. In seven patients who had definite evidence of hemorrhagic and exudative retinitis and who had previously been treated with diets high in fat and low in carbohydrate, I noticed that the retinal changes were either arrested or markedly diminished following the introduction of the normal diet. Two other patients volunteered the information that, "ever since I changed to the high carbohydrate diet, my eyesight has been much improved." It is true that in neither of these 2 cases was it possible to note any improvement in the appearance of the retina. Dr. Turner, at the Presbyterian Hospital in New York, has shown that the feeding of diets high in cholesterol to rabbits with the induction of hypercholesteremia is always followed by the development of definite symptoms of arteriosclerosis. This evidence suggests confirmation of the clinical theory that diets that are absolutely or relatively high in fat may be responsible for the development of arteriosclerosis, particularly if hypercholesteremia exists. While I do not think that all of the retinal changes commonly associated with diabetes can be prevented or cured by the normal diet, I think that abnormal diets such as those commonly used in the treatment of diabetes are more often accompanied by the development of various pathologic changes in the eye involving vascular structures than are normal diets.

DISCUSSION

DR. ARNOLD KNAPP: In cases of diabetes the most destructive and disastrous changes are found in the eyegrounds. It has been taught that diabetic retinitis is not a metabolic condition, but is due to a lesion of the arterial walls. At the same time, if one is fortunate enough to make a satisfactory examination with the ophthalmoscope, one does not find advanced changes in the arteries. Furthermore, these cases do not respond to any treatment of either the arteriosclerotic or the metabolic condition. They do not act like the cases of arteriosclerosis, because the patients continue to live. It seems to me that there must be some other factor to explain the condition, and I should like particularly to ask Dr. Geyelin to explain what he thinks of this type of case. Are the changes in blood cholesterol that he has outlined a feature in this severe type of retinitis?

DR. ARTHUR BEDELL: All ophthalmologists appreciate the importance of age when the condition of the retinal blood vessels is considered. Will Dr. Geyelin give the results of his observations in his last 500 cases?

DR. HENRY GEYELIN: From time immemorial until the use of the normal diet, diabetic patients have been subject to undernutrition coupled with high fat metabolism. In starvation, the body utilizes chiefly fat, in the ratio of from 3 to 5 Gm. of fat to 1 Gm. of protein and no carbohydrate. It seems more reasonable to believe that hypercholesteremia may be a factor in the production of arterial disease than that hyperglycemia may produce it. The feeding of a normal diet, made possible through the use of insulin, has seemed to bring about a decrease in the incidence of gangrene and a decrease in the number of patients suffering from symptoms of coronary disease.

Book Reviews

Studies on the Physiology of the Eye. By J. GRANDSON BYRNE. Price, 40 shillings. Pp. 428, with 48 illustrations. London: H. K. Lewis & Co., Ltd., 1933.

The author has done a great deal of experimental work during the last twenty years on pupillary, palpebral, lenticular and proptosing and retracting phenomena, as well as on paradoxical phenomena, following lesions of the afferent affective and proprioceptive paths, with and without the administration of various drugs, and with and without interruptions in the various efferent paths to the internal and external musculature of the eye. The results of more than 900 experiments on animals (mostly cats) are used by the author as a basis for his conclusions.

Byrne sums up by saying that the pupillary, palpebral and lens effector mechanisms consist of *A, B* and *C,* a narrowing or constrictor set (parasympathetic), and of A_1, B_1 and C_1, a widening or dilator set (sympathetic).

A and A_1 are least differentiated and at a chemical effector level, mediating paradoxical pupillary constriction and dilatation in response to agents such as pilocarpine acting at *A* and epinephrine at A_1. (Byrne also thinks that calcium is a stimulus for *A,* but, according to Auer and Meltzer [1909], this, in excess, acts only by rendering the dilator of the pupil less irritable so that a miosis results.)

B and B_1 are intermediate or chemiconeural, mediating inherent constrictor and dilator tomes, respectively, activation being initiated by chemical means in the constrictor and dilator center, respectively. Oxygen is the appropriate stimulus for *B,* and carbon dioxide for B_1.

C and C_1 are purely neural, mediating reflex constriction and dilation of the pupil, respectively. Reflex proprioceptive stimuli from other parts of the body stimulate *C,* while reflex affective (or nociceptive) stimuli act on C_1.

The constrictor or narrowing center (parasympathetic—nucleus of the third nerve) is served on its afferent side (*a*) by the proprioceptive system, which activates it, and (*b*) by paths from the dilator center, which inhibit it. The widening or dilator center (sympathetic) of Karplus and Kreidl (located in the hypothalamus, close to the crus cerebri) is served on its afferent side (*a*) by affective nervous impulses, which stimulate it, and (*b*) by the proprioceptive system, which inhibits it.

Certain of Byrne's statements and experimental results challenge contradiction. Thus, in chapter IX, he says that the pupil dilates preliminary to its contraction when light falls on the retina, basing his statement on flashlight pictures, and, on motion pictures taken by Weiler in 1910. Gradle and Eisendrath (*Klin. Monatsbl. f. Augenh.* **71:** 311, 1923) took motion pictures (with presumably better apparatus than that available in 1910) and then projected them on a screen 2 meters away for measuring the pupil. They found that there was no preliminary dilatation of the pupil following a light stimulus, and that the pupil contracted after a latent period of 0.1875 second. A repetition of this

work by Gradle and Ackerman (The Reaction Time of the Normal Pupil, *J. A. M. A.* **99:** 1334 [Oct. 15] 1932) gave similar results.

Also, the author thinks that the constriction of the pupil accompanying contraction of the orbicularis oculi is due to proprioceptive impulses initiated within the orbicularis itself which reach the pupillary constrictor center via the upper two divisions of the trigeminal nerve. While the experiments quoted seem to bear out this hypothesis, he might have mentioned the alternative hypothesis of Gifford (1895), that it was due to an overflow of nerve impulses from the facial nucleus to the cells of the constrictor center. Also, Mendel, in 1887, on the basis of his experiments showed that fibers supplying the orbicularis originated in the nucleus of the third nerve and subsequently joined the facial nerve, and Turner, in 1892, showed that ophthalmoplegia may be accompanied by paralysis of the orbicularis (and frontalis), apparently demonstrating that a single lesion could account for the clinical picture reported.

On page 112, the author mentions palpebral narrowing after the administration of from 0.00065 to 0.0013 Gm. of pilocarpine intravenously. It is well known in physiologic laboratories that a dose of this size is large for a cat, leading to intense tearing and salivation, and accompanied by increased reflexes, tremors and convulsions, owing to stimulation of the motor centers of the cord. It may well be that the palpebral narrowing was a toxic effect of the pilocarpine.

In chapter XXI, the author states that, from his experiments, the ciliary muscle receives both a sympathetic and a parasympathetic innervation, the former for accommodating for distance, the latter for near. While it is true that after the use of atropine, cocaine and epinephrine cause further dilation of the pupil, it is also true that after measuring the refraction of an atropinized eye, the injection of epinephrine and cocaine does not lead to any increase in hyperopia, which might be expected if the ciliary body had a dual innervation. Hess and Heine (1898), Römer and Dufour (1902) and Tuinzig (1905) also incline to the latter point of view, and Duke-Elder (Text Book of Ophthalmology, London, Henry Kimpton, 1932, vol. 1) believes that the mass of evidence is against the hypothesis that the sympathetic nerve plays an important rôle in accommodation.

The author's apparatus for measuring changes in the convexity of the lens by removing the cornea and having one arm of a lever rest on the lens, the other end acting as a writing point, sounds rather crude, and, from the description, it would seem more likely to measure a forward or backward movement of the lens or a change in the volume of the choroid.

Moreover, since Byrne built up an elaborate theory in which A and A_1 are supposed to function at a chemical level, the work of Loewi on "vagus substance" (acetylcholine) and of Cannon on "sympathin," which has been available for at least ten years, certainly deserved mention and should have been used in building up his schema.

One obvious fault with the book is that the author has derived most of his references from the literature prior to 1905. A great mass of work has been done within recent years, affirming or disproving earlier findings and should have, I think, been utilized by Byrne. Some of the illustrations are good, but others do not demonstrate positively the facts elucidated by the author.

The book is not one which the clinician needs on his bookshelf, but the research ophthalmologist and physiologist will find plenty in it to stimulate their interest and possibly lead them either to verify or to refute Bryne's conclusions.

W. F. DUGGAN.

Allergy and Immunity in Ophthalmology. By Alan C. Woods, M.D. The Wilmer Ophthalmological Institute, The Johns Hopkins Hospital and University. Price, $2.25. Pp. 176. Baltimore: Johns Hopkins Press. 1933.

This excellently written book from the pen of Dr. Woods deals fairly and exhaustively with this phase of ophthalmologic work. It brings up to date the facts and theories relating to this side of the work. It deals with the scientific and clinical aspects of all the ocular lesions classified as allergic and bacteriologic. In plain terms, it deals with present conceptions of such lesions from both the experimental and the clinical standpoint. One is at once struck by the advances made in knowledge of the causation of such lesions in the last quarter of a century, but one also realizes how much further advanced is the experimental knowledge than the practical or clinical knowledge.

On analyzing the book as a whole, one finds that the rationale of allergy is dealt with in all its phases. One point that is usually overlooked is stressed, namely, that drugs and carbohydrates, in addition to proteins, can produce this phenomenon. Thus, the action of atropine and butyn in this regard and the importance of histamine poisoning, especially from the intestinal tract, are shown. The latter point is important. The effect of deficiency in vitamins on antigenic cutaneous reactions is also stressed. The differences between true focal infections, those from bacterial products and the allergic phenomena are also clearly outlined.

The disputed questions as to the etiology of vernal catarrh and trachoma are dealt with at length, and the various theories are well set forth. One gains also fair knowledge as to the allergic phenomena that cause sympathetic ophthalmitis; the question is discussed from all angles. The question of the antigenic properties of the lens is also presented.

A special chapter is devoted to the allergic phenomena of syphilis and another to tuberculosis. The latter is especially important as it deals with the diagnostic and therapeutic uses of tuberculin.

The chapter on nonspecific protein therapy is excellent, and one gains a good working knowledge of the basis of such an agent.

All in all, this book was badly needed by the ophthalmologist. Any one who has felt a lack of laboratory or research knowledge will find this book indispensable.

J. G. DWYER.

Anatomy of the Eye and Orbit. By Eugene Wolff, M.B., B.S., F.R.C.S. Price, $7.50. Pp. 310, with 173 illustrations. Philadelphia: P. Blakiston's Son & Co., 1933.

For many years Whitnall's "Anatomy of the Human Orbit" and Salzmann's "Anatomy and Histology of the Human Eyeball" have been standard works of reference for ophthalmologists. Mr. Wolff has taken

as his province the fields covered by the aforementioned books, and has produced a creditable volume.

The author takes up, in the following order, the bony orbit and accessory sinuses, the eyeball, lids, conjunctiva, lacrimal apparatus, normal slit-lamp findings, extrinsic muscles of the eye, nerves (motor, sensory, autonomic) and blood vessels, and closes with chapters on the development and comparative anatomy of the eye.

The book is briefly but concisely written, containing only the essentials of the anatomy of this region. One admirable feature is the inclusion of practical clinical and operative applications of various anatomic features as they are mentioned in the text.

The author has included illustrations from works by Quain, Salzmann, Greeff, and Brouwer and Zeeman, but most of the plates are from original dissections made by the author and are refreshing to the eye. His diagram on page 135, of the action of the extrinsic muscles of the eye, is confusing, although the difficulty is cleared up after one has read the text. The book as a whole is more than adequate, and the typography, illustrations and diagrams are excellent.

W. F. DUGGAN.

Directory of Ophthalmologic Societies *

INTERNATIONAL

International Association for Prevention of Blindness

President: Prof. F. de Lapersonne, 217, Faubourg St. Honoré, Paris.
Secretary-General pro tem.: Dr. A. Churchill, 66 Boulevard St. Michel, Paris.

International Ophthalmologic Congress

Secretary: Dr. Francisco Poyales, Olozaga 3, Madrid.

FOREIGN

British Medical Association, Section on Ophthalmology

President: Dr. Frank H. Crawley, 5 Fitzwilliam Pl., Dublin.

Ophthalmological Society of Bombay

President: Dr. D. D. Sathaye, 127 Girgaum Road, Bombay 4.
Secretary: Dr. H. D. Dastur, Dadar, Bombay, 14.
Place: H. B. A. Free Ophthalmic Hospital, Parel, Bombay 12. Time: First Friday of every month.

Ophthalmological Society of the United Kingdom

President: Mr. A. H. H. Sinclair, 6 Charlotte Square, Edinburgh.
Secretary: Mr. Humphrey Neame, 56 Portland Place, London, W. I.

Oxford Ophthalmological Congress

Master: Dr. Cyril Walker, Bristol, England.
Secretary: Dr. C. G. Russ Wood, Hill House, Abberbury Rd., Iffley, Oxford, England.

Royal Society of Medicine, Section of Ophthalmology

President: Dr. A. C. Hudson, 50, Queen Anne St., W. 1, London.
Secretary: Dr. J. D. Magor Cardell, 27, Weymouth St., W. 1, London.

Société Française d'Ophthalmologie

Secretary: Dr. René Onfray, 6 avenue de la Motte Picquet, Paris 7è.

German Ophthalmological Society

Secretary: Prof. A. Wagenmann, Heidelberg.
Time: 1934.

NATIONAL

American Medical Association, Section on Ophthalmology

Chairman: Dr. William C. Finnoff, 1612 Tremont St., Denver.
Secretary: Dr. Parker Heath, 1551 Woodward Ave., Detroit.
Place: Cleveland. Time: June 11-15, 1934.

American Academy of Ophthalmology and Oto-Laryngology

President: Dr. B. R. Shurley, 62 W. Adams Ave., Detroit.
President-Elect: Dr. J. M. Wheeler, 30 W. 59th St., New York.
Executive Secretary-Treasurer: Dr. William P. Wherry, 1500 Medical Arts Bldg., Omaha.

---

* Secretaries of societies are requested to furnish the information necessary to make this list complete and to keep it up to date.

American Ophthalmological Society

President: Dr. W. G. M. Byers, 1458 Mountain St., Montreal.
Secretary-Treasurer: Dr. J. Milton Griscom, 2213 Walnut St., Philadelphia.
Place: Lucerne, Que. Time: July 9-11, 1934.

SECTIONAL

New England Ophthalmological Society

President: Dr. Hugo B. C. Riemer, 128 Newbury St., Boston.
Secretary-Treasurer: Dr. Benjamin Sachs, 483 Beacon St., Boston.
Place: Massachusetts Eye and Ear Infirmary, 243 Charles St., Boston. Time: 8 p. m., third Tuesday of each month from November to April, inclusive.

Pacific Coast Oto-Ophthalmological Society

President: Dr. A. W. Morse, 66 W. Park St., Butte, Montana.
Secretary-Treasurer: Dr. Frederick C. Cordes, 384 Post St., San Francisco.

Puget Sound Academy of Ophthalmology and Oto-Laryngology

President: Dr. H. R. Secoy, 1802 Hewitt Ave., Everett, Wash.
Secretary-Treasurer: Dr. Francis A. Brugman, 806 Cobb Bldg., Seattle.
Time: 8 p. m., third Tuesday of each month, except July and August.

Saginaw Valley Academy of Ophthalmology and Otolaryngology

President, Dr. A. R. McKinney, 703 Second National Bank Bldg., Saginaw, Mich.
Secretary-Treasurer: Dr. W. K. Slack, 308 Eddy Bldg., Saginaw, Mich.
Place: Saginaw, Mich., or Bay City, Mich. Time: First Friday of each month, except July and August.

Sioux Valley Eye and Ear Academy

President: Dr. John B. Gregg, 101 S. Main St., Sioux Falls, S. Dakota.
Secretary-Treasurer: Dr. F. H. Roost, 420 Trimble Bldg., Sioux City, Iowa.

Southern Medical Association, Section on Eye, Ear, Nose and Throat

Chairman: Dr. William D. Gill, 323 Medical Arts Bldg., San Antonio, Texas.
Secretary: Dr. William A. Wagner, 200 Carondelet St., New Orleans.
Place: Richmond, Va. Time: November, 1933.

Southwestern Michigan Triological Society

President: Dr. Carl Snapp, 604 Medical Arts Bldg., Grand Rapids.
Secretary-Treasurer: Dr. Lee O. Grant, 420 Medical Arts Bldg., Grand Rapids.
Time: Third Thursday of alternate months.

STATE

Colorado Ophthalmological Society

President: A presiding officer is selected for each meeting alternately until all members have served.
Secretary: Dr. Edna M. Reynolds, 920 Republic Bldg., Denver.
Place: Capitol Life Building, Denver. Time: 7:30 p. m., third Saturday of the month, October to April, inclusive.

Connecticut State Medical Society, Section on Eye, Ear, Nose and Throat

President: Dr. Edward J. Whalen, 750 Main St., Hartford.
Secretary-Treasurer: Dr. Walter L. Hogan, 750 Main St., Hartford.
Time: May, November.

Eye, Ear, Nose and Throat Club of Georgia

President: Dr. W. R. Bedingfield, 753 Broad St., Augusta.
Secretary-Treasurer: Dr. J. A. Smith, 700 Spring St., Macon.
Place: Augusta. Time: May, 1934.

Indiana Academy of Ophthalmology and Oto-Laryngology

President: Dr. Robert J. Masters, 805 Hume-Mansur Bldg., Indianapolis.
Secretary: Dr. J. Kent Leasure, 23 E. Ohio St., Indianapolis.
Place: Indianapolis. Time: Dec. 13, 1933.

Iowa Academy of Ophthalmology and Oto-Laryngology

President: Dr. W. W. Pearson, 410 Sixth Ave., Des Moines.
Secretary-Treasurer: Dr. W. F. Boiler, 105 E. Iowa Ave., Iowa City.

Michigan State Medical Society, Section of Ophthalmology and Otolaryngology

Chairman: Dr. Ray Connor, 28 W. Adams Ave., Detroit.
Secretary: Dr. Ralph B. Fast, 136 E. Michigan Ave., Kalamazoo.

Minnesota Academy of Ophthalmology and Oto-Laryngology

President: Gordon B. New, Mayo Clinic, Rochester.
Secretary-Treasurer: Dr. Walter E. Camp, Medical Arts Bldg., Minneapolis.
Time: Second Friday of each month from October to May.

Montana Academy of Oto-Ophthalmology

President: Dr. Lawrence G. Dunlap, 101 Main St., Anaconda.
Secretary: Dr. A. W. Morse, Phoenix Bldg., Butte.

New Jersey State Medical Society, Section on Ophthalmology, Otology and Rhinolaryngology

Chairman: Dr. S. T. Hubbard, 294 State St., Hackensack.
Secretary: Dr. G. S. Laird, 125 Central Ave., Westfield.
Place: Atlantic City. Time: June, 1934.

New York State Medical Society, Eye, Ear, Nose and Throat Section

Chairman: Dr. Frank M. Sulzman, 1831 Fifth Ave., Troy.
Secretary: Dr. Webb W. Weeks, 20 E. 53rd St., New York.
Place: Utica. Time: May 14-16, 1934.

North Dakota Academy of Ophthalmology and Oto-Laryngology

President: Dr. H. O. Ruud, 318 De Mers Ave., Grand Forks.
Secretary-Treasurer: Dr. F. L. Wicks, 516 Fourth St., Valley City.
Place: Valley City. Time: 1934.

Oregon Academy of Ophthalmology and Oto-Laryngology

President: Dr. A. B. Dykman, Medical Dental Bldg., Portland.
Secretary-Treasurer: Dr. Andrew J. Browning, 418 Mayer Bldg., Portland.
Place: Good Samaritan Hospital. Time: Third Tuesday of each month.

Rhode Island Ophthalmological and Otological Society

President: Dr. Robert C. O'Neil, 105 Waterman St., Providence.
Secretary: Dr. Gordon J. McCurdy, 122 Waterman St., Providence.
Place: Rhode Island Medical Library. Time: 8:30 p. m., second Thursday in October, December, February and April.

South Carolina Society of Ophthalmology and Otolaryngology

President: Dr. Walter Bristow, Medical Bldg., Columbia.
Secretary: Dr. J. W. Jervey, Jr., 101 Church St., Greenville.

Tennessee Academy of Ophthalmology and Otolaryngology

President: Dr. C. D. Blassingame, 899 Madison Ave., Memphis.
Secretary-Treasurer: Dr. Ralph O. Rychener, 130 Madison Ave., Memphis.

Texas Ophthalmological and Oto-Laryngological Society

President: Dr. O. S. Hodges, 388 Pearl St., Beaumont.
Secretary: Dr. A. F. Clark, 1034 Nix Professional Bldg., San Antonio.

Utah Ophthalmological Society

President: Dr. W. T. Hasler, 290 W. Center St., Provo.
Secretary-Treasurer: Dr. T. F. Welsh, 920 Boston Bldg., Salt Lake City.
Time: Third Monday of each month.

Virginia Society of Oto-Laryngology and Ophthalmology

President: Dr. H. G. Preston, 307 Professional Bldg., Harrisonburg.
Secretary: Dr. Edwin W. Burton, 104 E. Market St., Charlottesville.

West Virginia State Medical Association, Eye, Ear, Nose and Throat Section

President: Dr. Harry V. Thomas, 95 Fairmont Ave., Fairmont.
Secretary: Dr. W. F. Beckner, 1050 5th Ave., Huntington.

LOCAL

Academy of Medicine of Northern New Jersey, Section on Eye, Ear, Nose and Throat

Chairman: Dr. Browne Morgan, 260 Liberty St., Bloomfield.
Secretary: Dr. A. Russell Sherman, 671 Broad St., Newark.
Place: 91 Lincoln Park South. Time: 8:45 p. m., second Monday of each month.

Academy of Medicine of Toronto, Section of Ophthalmology

Chairman: Dr. Colin Campbell, 170 St. George St., Toronto.
Secretary: Dr. H. M. Macrae, 170 St. George St., Toronto.
Time: First Monday of winter months.

Atlanta Eye, Ear, Nose and Throat Society

President: Dr. G. E. Clay, 384 Peachtree St., N. E., Atlanta, Ga.
Secretary: Dr. William O. Martin, Jr., Medical Arts Bldg., Atlanta, Ga.
Place: Academy of Medicine, 38 Prescott St., N. E. Time: 8 p. m., last Thursday of each month.

Baltimore Medical Society, Section on Ophthalmology

Chairman: Dr. Benjamin Rones, Johns Hopkins Hospital, Baltimore.
Secretary: Dr. William M. Rowland, 906 Cathedral St., Baltimore.
Place: Medical and Chirurgical Faculty, 1211 Cathedral St. Time: 8:30 p. m., fourth Thursday of each month from October to May.

Brooklyn Ophthalmological Society

President: Dr. W. F. C. Steinbugler, 515 Ocean Ave., Brooklyn.
Secretary: Dr. Walter V. Moore, 1 Nevins St., Brooklyn.
Place: Kings County Medical Society Bldg., 1313 Bedford Ave. Time: Third Thursday in February, April, May, October and December.

Buffalo Ophthalmologic Club

President: Dr. H. H. Glosser, 448 Franklin St., Buffalo.
Secretary-Treasurer: Dr. I. J. Koenig, 40 North St., Buffalo.

Chicago Ophthalmological Society

President: Dr. Dwight C. Orcutt, 30 N. Michigan Ave., Chicago.
Secretary: Dr. Richard C. Gamble, 30 N. Michigan Ave., Chicago.
Place: Medinah Michigan Avenue Club, 505 N. Michigan Ave. Time: Third Monday of each month from October to May.

Cleveland Academy of Medicine, Section of Ophthalmology and Oto-Laryngology

Chairman: Dr. Justin M. Waugh, Cleveland Clinic, Cleveland.
Secretary: Dr. James T. Collins, 1105 Medical Arts Bldg., Cleveland.
Place: Winton Hotel. Time: Fourth Friday of each month.

Cleveland Ophthalmological Club

Chairman: Dr. W. P. Chamberlain, 7405 Detroit Ave., Cleveland.
Secretary: Dr. A. D. Ruedemann, Cleveland Clinic, Cleveland.

College of Physicians, Philadelphia, Section on Ophthalmology

Chairman: Dr. L. F. Appleman, 308 S. Sixteenth St., Philadelphia.
Clerk: Dr. Alexander G. Fewell, 1924 Pine St., Philadelphia.
Time: Third Thursday of every month from October to April, inclusive.

Columbus Ophthalmological and Oto-Laryngological Society

Chairman: Dr. Albert D. Frost, 681 E. Broad St., Columbus, Ohio.
Secretary-Treasurer: Dr. M. Goldberg, 328 E. State St., Columbus, Ohio.
Time: First Monday of each month.

Dallas Academy of Ophthalmology and Oto-Laryngology

President: Dr. T. S. Love, 1719 Pacific Ave., Dallas, Texas.
Secretary: Dr. Daniel Brannin, 1719 Pacific Ave., Dallas, Texas.
Place: Dallas Athletic Club. Time: 6:30 p. m., first Tuesday of each month from October to June. The November, January and March meetings are devoted to clinical work.

Des Moines Academy of Ophthalmology and Otolaryngology

President: Dr. Cecil C. Jones, 1121 Equitable Bldg., Des Moines, Iowa.
Secretary-Treasurer: Dr. Grace Doane, 614 Bankers Trust Bldg., Des Moines, Iowa.
Time: 7:45 p. m., third Monday of every month, September to May.

Detroit Ophthalmological Club

Chairman: Members rotate alphabetically.
Secretary: Dr. Raymond S. Goux, David Whitney Bldg., Detroit.
Time: 6:30 p. m., first Wednesday of each month.

Eastern New York Eye, Ear, Nose and Throat Association

President, Dr. Edward B. O'Keefe, 901 State St., Schenectady.
Secretary-Treasurer: Dr. W. C. Mott, 118 Washington Ave., Albany.
Time: Third Wednesday in October, November, March, April, May and June.

Fort Worth Eye, Ear, Nose and Throat Society

President: Dr. Valin R. Woodward, Flatiron Bldg., Forth Worth, Texas.
Secretary-Treasurer: Dr. Van D. Rathgeber, 1012 Medical Arts Bldg., Fort Worth.
Place: Medical Hall, Medical Arts Bldg. Time: 7:30 p. m., first Friday of each month except July and August.

Grand Rapids Eye, Ear, Nose and Throat Society

President: Dr. Carl F. Snapp, 26 Sheldon Ave., Grand Rapids, Mich.
Secretary-Treasurer: Dr. Walter W. Oliver, 320 Medical Arts Bldg., Grand Rapids, Mich.
Place: Various local hospitals. Time: Third Thursday of alternating months, September to May.

Houston Academy of Medicine, Eye, Ear, Nose and Throat Section

President: Dr. J. F. Gamble, 201 Main St., Houston, Texas.
Secretary: Dr. B. F. Payne, 1304 Walker Ave., Houston, Texas.
Place: Medical Arts Bldg., Harris County Medical Society Rooms. Time: 8 p. m., second Thursday of each month from September to June.

Indianapolis Ophthalmological and Oto-Laryngological Society

President: Dr. D. A. Bartley, 23 E. Ohio St., Indianapolis.
Secretary: Dr. Kenneth L. Craft, 23 E. Ohio St., Indianapolis.
Place: University Club. Time: 6:30 p. m., second Thursday of each month from October to May.

Kansas City Society of Ophthalmology and Oto-Laryngology

President: Dr. M. B. Simpson, 1103 Grand Ave., Kansas City, Mo.
Secretary: Dr. Harold B. Hedrick, 618 Professional Bldg., Kansas City, Mo.
Time: Third Thursday of each month from September to May. The November, January and March meetings are devoted to clinical work.

Long Beach Eye, Ear, Nose and Throat Society

Chairman: Dr. Clifford S. Losey, 219 E. 10th St., Long Beach, Calif.
Secretary-Treasurer: Dr. Kenneth C. Brandenburg, 707 Security Bldg., Long Beach, Calif.
Place: Professional Bldg. Time: Last Wednesday of each month from October to May.

Los Angeles Society of Ophthalmology and Oto-Laryngology

President: Dr. D. E. Godwin, 910 Security Bldg., Long Beach, Calif.
Secretary-Treasurer: Dr. F. H. Brandt, 1052 W. Sixth St., Los Angeles.
Place: Los Angeles County Medical Association, 1925 Wilshire Blvd. Time: 6:30 p. m., fourth Monday of each month from September to May, inclusive.

Louisville Eye, Ear, Nose and Throat Society

President: Dr. Karl N. Victor, Breslin Bldg., Louisville, Ky.
Secretary-Treasurer: Dr. J. S. Bumgardner, Heyburn Bldg., Louisville, Ky.
Place: French Village. Time: Second Thursday of each month, September to May, inclusive, at 6:30 p. m.

Medical Society of the District of Columbia, Section of Ophthalmology and Oto-Laryngology

Chairman: Dr. George B. Trible, 1801 I St., Washington.
Secretary: Dr. Harry F. Davies, 1835 I St., Washington.
Place: 1718 M St., N. W. Time: 8 p. m., third Friday of each month from October to April, inclusive.

Memphis Society of Ophthalmology and Otolaryngology

Chairman: Each member, in alphabetical order.
Secretary: Dr. R. O. Rychener, Exchange Bldg., Memphis, Tenn.
Place: Eye Clinic of Memphis Eye, Ear, Nose and Throat Hospital. Time: 8 p. m., second Tuesday of each month.

Milwaukee Oto-Ophthalmic Society

President: Dr. Samuel G. Higgins, 324 E. Wisconsin Ave., Milwaukee.
Secretary-Treasurer: Dr. O. P. Schoofs, 324 E. Wisconsin Ave., Milwaukee.
Place: University Club. Time: 6:30 p. m., third Tuesday of each month.

Montreal Ophthalmological Society

President: Dr. J. P. E. Bousquet, 66 Sherbrooke St., West, Montreal, Canada.
Secretary: Dr. J. A. MacMillan, 1410 Stanley St., Montreal, Canada.
Time: Second Thursday of October, December, February and April.

Nashville Academy of Ophthalmology and Otolaryngology

Chairman: Dr. Eugene Orr, 706 Church St., Nashville, Tenn.
Secretary-Treasurer: Dr. H. C. Smith, Medical Arts Bldg., Nashville, Tenn.
Place: St. Thomas Hospital. Time: 8 p. m., third Monday of each month from October to June.

New Orleans Ophthalmological and Otolaryngological Society

President: Dr. M. F. Meyer, Canal Bank Bldg., New Orleans.
Secretary-Treasurer: Dr. R. H. Fisher, Chess and Checker Club, New Orleans.
Place: Eye, Ear, Nose and Throat Hospital. Time: Third Thursday of each month from October to June.

New York Academy of Medicine, Section of Ophthalmology

Chairman: Dr. Webb William Weeks, 20 E. 53rd St., New York.
Secretary: Dr. Guernsey Frey, 121 E. 60th St., New York.
Time: 8:30 p. m., third Monday of every month from October to May, inclusive.

Omaha and Council Bluffs Ophthalmological and Oto-Laryngological Society

President: Dr. L. G. Howard, 532 First Ave., Council Bluffs, Iowa.
Secretary-Treasurer: Dr. W. A. Cassidy, 1620 Medical Arts Bldg., Omaha.
Place: Omaha Club, 20th and Douglas Sts., Omaha. Time: 6 p. m., dinner; 7 p. m., program; third Wednesday of each month from October to May.

Philadelphia County Medical Society, Eye Section

Chairman: Dr. Charles R. Heed, 1205 Spruce St., Philadelphia.
Secretary: Dr. Sidney L. Olsho, 235 S. 15th St., Philadelphia.
Time: Second Tuesday of each month from October to May.

Pittsburgh Ophthalmological Society

President: Dr. Edward B. Heckel, Jenkins Arcade Bldg., Pittsburgh.
Secretary: Dr. George H. Shuman, Park Bldg., Pittsburgh.
Place: Pittsburgh Academy of Medicine Bldg. Time: Fourth Monday of each month, except June, July, August and September.

Pittsburgh Slit-Lamp Society

President: Dr. W. W. Blair, 121 University Pl., Pittsburgh.
Secretary: Dr. George H. Shuman, Park Bldg., Pittsburgh.
Place: 121 University Pl. Time: Second Monday evening of every month, except June, July, August and September.

Richmond Ophthalmological and Oto-Laryngological Society

President: Dr. R. W. Vaughan, Medical Arts Bldg., Richmond, Va.
Secretary: Dr. William R. Weisiger, Medical Arts Bldg., Richmond, Va.
Place: Westmoreland Club. Time: 6 p. m., second Monday of each month from October to May.

Rochester Eye, Ear, Nose and Throat Society

Chairman: Dr. W. E. Munroe, 277 Alexander St., Rochester, N. Y.
Secretary-Treasurer: Dr. E. W. O'Brien, 5 N. Goodman St., Rochester, N. Y.
Place: Rochester Medical Association, 113 Prince St. Time: 8 p. m., third Monday of each month from October to May.

St. Louis Ophthalmic Society

President: Dr. Max W. Jacobs, Missouri Theatre Bldg., St. Louis.
Secretary: Dr. Carl T. Eber, 1006 Carleton Bldg., St. Louis.
Place: Oscar Johnson Institute. Time: Clinical meeting 5:30 p. m., dinner and scientific meeting 6:30 p. m., fourth Friday of each month from October to April, inclusive, except December.

San Antonio Ophthalmolo-Oto-Laryngological Society

President: Dr. Robert E. Parrish, 712 Medical Arts Bldg., San Antonio, Texas.
Secretary-Treasurer: Dr. E. King Gill, 323 Medical Arts Bldg., San Antonio, Texas.
Place: Bexar County Medical Library. Time: 8 p. m., first Tuesday of each month from October to May.

San Francisco County Medical Society, Section on Eye, Ear, Nose and Throat

Chairman: Dr. George N. Hosford, 490 Post St., San Francisco.
Secretary: Dr. Russell Fletcher, 490 Post St., San Francisco.
Place: Society's Building, 2180 Washington St., San Francisco.
Time: Fourth Tuesday of every month except May, June, July and December

Shreveport Eye, Ear, Nose and Throat Society

President: Dr. T. D. Boaz, Medical Arts Bldg., Shreveport, La.
Secretary-Treasurer: Dr. W. L. Atkins, 940 Margaret Pl., Shreveport, La.
Place: 1240 Texas Ave. Time: 7:30 p. m., first Monday of each month from October to June.

Spokane Academy of Ophthalmology and Oto-Laryngology

President: Dr. C. A. Veasey, Jr., 407 Riverside Ave., Spokane, Wash.
Secretary: Dr. J. L. Walter, Paulsen Medical and Dental Bldg., Spokane, Wash.
Place: Paulsen Medical and Dental Library. Time: 8 p. m., fourth Tuesday of each month except June, July and August.

Syracuse Eye, Ear, Nose and Throat Society

President: Dr. H. O. Brust, 820 S. Crouse Ave., Syracuse, N. Y.
Secretary-Treasurer: Dr. W. J. Werfelmann, 109 S. Warren St., Syracuse, N. Y.
Place: University Club. Time: Second Friday of each month except June, July and August.

Tulsa Academy of Ophthalmology and Otolaryngology

President: Dr. Roy Dunlap, Medical Arts Bldg., Tulsa, Okla.
Secretary-Treasurer: Dr. Marvin D. Henley, Medical Arts Bldg., Tulsa, Okla.
Place: Medical Arts Bldg. Time: Monthly.